Electrical World

The Consolidation of Electrical World and Engineer and American Electrician.

Vol. XLVII. NEW YORK, SATURDAY, JUNE 9, 1906. No. 23.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 Liberty Street, New York.

Telephone Call: 7605 Cortlandt. Cable Address: Electrical, New York.

Edited by T. C. Martin and W. D. Weaver.

Chicago Office.....1139 Monadnock Block
Philadelphia Office.....Real Estate Trust Building
Cleveland Office.....405 Cuyahoga Building
European Office.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION

United States, Canada, Cuba and Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
Great Britain and Ireland.....25 shillings
Germany.....25 marks
France.....31 francs
Single copy.....10 cents

Remittances for foreign subscriptions may be made through our European office. Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

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Entered as second-class matter at the post office at New York, N. Y., under the Act of Congress of March 3, 1879.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the Electrical World *16,500 copies are printed. Total circulation for 1906 to date, 442,500, an average of 19,239 per week.*

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Atlantic City Convention of the N. E. L. A.....Supplement

National Electric Light Convention.

As we go to press the Atlantic City Convention of the National Electric Light Association is in full swing, with every promise of being one of the most successful meetings in the history of that body. As the report of the proceedings cannot be prepared in time for printing in the body of this issue, abstracts of the papers and of the discussion of the papers read prior to Thursday will be printed in a supplement forming part of this number.

Lightning Protection.

The N. E. L. A. report on this subject, presented at Atlantic City, makes, as usual, interesting reading. Obviously, the information obtained by the committee regarding individual troubles must be rather meagre, since only immediate investigation on the ground can do the matter up with real thoroughness; but when enough reports are received to give the statistical method proper weight, the conclusions are valuable. The fact which stands out very conspicuously in the results here reported is the impartial way in which Jove distributes his favors. All classes of plants suffered, the low-tension and the high-tension in about equal proportion, and as usual the transformers bore the brunt of the attack. It seems probable that the high-tension lines should be credited on the whole with a rather better chance of immunity than the low-tension ones, perhaps because of higher factors of safety in some parts of the insulation; but the difference is not very great. It appears mainly in the matter of accidents from lightning per mile of line, and even this information is far from definite. If two companies, each working with a factor of safety of, say, 3 in the insulation, operate one at 2,300 volts and the other at 10,000 volts, the former should have on general principles rather the more trouble from lightning since it has an absolute margin of safety of 4,600 volts as against 20,000 volts in the latter. A certain rather large proportion of lightning discharges of the less severe sort would break down the former and would fail against the higher insulation, which is perhaps enough to account for the observed facts. In case of severe discharges the difference in insulation strength becomes insignificant.

We note one case in which a plant with small 6,600-volt generators suffered repeated damage to the armatures in spite of the lightning arresters. In such an instance the resonance theory propounded by the committee offers a simple explanation of the facts, although we think a still simpler one may be the lack of a proper factor of safety in the armature insulation, the generators being of exceptionally high voltage for their output, so that there would be a considerable chance of reduced insulation to save space in the slots. In general, armatures seem to have suffered little, the transformers being the weak point or at least the point of greatest danger. As to the means taken for protection, there seems to have been gradual improvement in the performance, the complaints being directed mainly at some weak points in the arresters themselves, notably the resistances. It is no easy matter to provide high resistance of large instantaneous carrying capacities, which at the same time shall be cheap and compact. In order that the series resistance may be

enough to prevent disastrous results, it cannot be reduced with impunity, and being kept high, there is a tremendous concentration of energy when trouble comes.

To our notion the arrester with shunted gaps offers by far the best chance for good general results, but neither it nor any other form can be greatly reduced in size without getting into trouble. Arresters are best made big enough and robust enough to stand hard knocks without being put out of service. One matter of interest in the reports relates to the grounded guard wire. On the face of the facts the guard wires cut very little figure in the results. Ten cases of their use were reported and six companies suffered from lightning. Of companies not using such wires, 94 reported, and of these 48 had injuries to report. As the committee remarks, such wires on distribution systems are a nuisance. If used anywhere with effect, it would be in our judgment on particularly exposed parts of certain transmission lines, where it might pay to install stranded cables of size sufficient to avoid mechanical difficulties. Next year we hope the committee will turn special attention to the effect of steel poles and tower construction upon troubles from lightning. Owing to the freedom with which such construction is now employed, the coming year should yield data enough to be of real value. One of the most valuable suggestions in the report is that for the symtomatic treatment of lightning troubles. Experience certainly shows that lightning does strike twice in the same place—in fact shows an apparent liking for certain localities, sometimes exposed hill tops, at other times narrow valleys. The topographical relations of thunderstorms need investigation, and lacking general data, the individual engineer should look into it on his own account. One cannot determine the location of his line on this basis, but he can at least lay out a special system of protection to cover points shown by experience to be dangerous. Dealing with lightning at present is a frankly empirical matter, which needs united effort for its elucidation.

Measuring Sparking Voltages.

The sparking distance in air with varying voltage is always an interesting problem and practically important in many ways. The results are also very discordant, as a general rule. Everything depends upon the experimental conditions. Air has, perhaps, a definite electric strength at a given pressure and temperature, depending upon the conditions permitting and suppressing ionisation. There are, however, at least two sources of disturbances in observing this dielectric strength. One is the action which occurs at the surface of any electrode, no matter how flat or smooth, possibly in a surface condensation layer of gas, whereby an initial voltage must be applied to split this film electrically, before allowing for the strength of the air between the electrodes. The other disturbing cause is the wedge cleavage action of points, edges or convexities on the electrodes. Air which would stand three kilovolts per millimetre as a slab between opposed flat electrodes, may give way at one kilovolt per millimetre between slightly rounded electrodes, at 800 volts per mm. between sharply rounded electrodes and at 500 volts per mm. between sharp needle points. An interesting method of measuring direct-current sparking voltages appears in a paper read by Mr. E. A. Watson before the Birmingham Section of the British Institution of Electrical Engineers, an abstract of which is given in the Digest. A Wimshurst electrical machine charges a pair of condensers in series, and the average current strength of the charging current is observed. The number of spark discharges per minute over a measured spark-gap is also observed. From these data the average total electric quantity in each discharge is readily obtained, and hence the average discharging voltage of the condensers. Using discharging knobs of different sizes the mean electric strength of the air in the spark gap varied between 3.5 kilovolts per mm. between 1¼″ balls at 1 cm. apart, and 1.05 kilovolts per mm. between ¾″ balls at 9 cm. apart.

Current Locus of the Induction Motor.

The graphic method set forth in the articles of Dr. A. S. M'Allister appearing in our issues of the 21st of April and 26th of May, and commented upon elsewhere in this issue by Mr. B. A. Behrend, constitutes a distinct advance in the engineering theory of the polyphase induction motor. A similar advance was made in the engineering theory of the transformer by the convention of the equivalent level transformer and its equivalent conductive circuit. This convention overjumped the insulating barrier between primary and secondary windings and made them both parts of one and the same circuit. The polyphase induction motor was also known to be capable of similar treatment, with the further convention of a fictitious resistance load in the secondary part of the circuit, the magnitude of this fictitious resistance being a function of the slip. Owing, however, to the large magnetizing current in the induction motor, viewed as a transformer, the equivalent circuit diagram did not much simplify the theory; because, according to that theory, the leakage circuit representing the excitation, had to be placed midway between the primary and secondary winding. By boldly transgressing this rule and placing the leakage circuit across the outside mains, Dr. M'Allister has greatly simplified the problem, without incurring an excessive penalty of error. He has been cruel to rigid accuracy, only to be kind to the student of engineering and the designer of induction motors. On the basis of the new convention, and assuming the locus of the vector primary current in a polyphase induction motor to be a simple circle, as first pointed out by Behrend and Heyland, all approximate computations connected therewith are now greatly abridged.

The Maintenance and Calibration of Service Meters.

The paper on this subject by Mr. William Bradshaw, read at the Atlantic City Convention of the National Electric Light Association, well illustrates the types of apparatus necessary in order to maintain customer's recording watt-hour meters in good operating condition. First comes the portable standard watt-hour meter, which is carried by the inspector to the house where the meter to be tested is installed. The portable standard is placed in circuit with the tested instrument, and the test is made by observing the difference in speeds on selected loads. The portable standard is calibrated to a declared degree of accuracy of 2 per cent, at all loads from 2 per cent to 150 per cent of full load. It is checked from time to time, at the office, by comparison with a precision wattmeter calibrated to a declared precision of one-seventh of 1 per cent at full load. This precision wattmeter, or station standard, is itself checked, at longer intervals, by comparison with potentiometers, either in the station, the factory, or a standardizing bureau. Consequently there is a sort of apostolic succession between the primary standards kept at Washington and the customer's watt-hour meters in Maine or Texas, whereby, by the laying on of hands, in a succession that may often be remote, the international volt as determined by

standard cells, acquires sway over the dials of the distant meter, the degree of possible inaccuracy ever broadening as the pathway from Washington gets longer, and time or decay assert their influence. Sooner or later, however, the watt-hour meter which rebels against the international watt becomes withdrawn from service and the international watt is kept on tap all over the land with a reasonable or commercial degree of precision.

LINE CONSTRUCTION.

The paper read by Mr. Paul Spencer before the Atlantic City N. E. L. A. convention on line construction is a very valuable résumé of good practice, which may be well taken as a guide to first-class work. If its suggestions are carried out the result will be a system which should give singularly efficient and reliable service. We especially would call attention to his sharp condemnation of so-called temporary work which has been responsible for no small amount of bad service and many accidents. There are occasions when hasty work has to be done, but there is no time when it should be allowed to rest as good enough. Construction in ordinary distributing plants is so frequently careless that an unnecessary prejudice against overhead circuits has been created, to the great cost of many a company thereby forced into conduit work long before conditions have warranted it. And we want to add to Mr. Spencer's remarks concerning danger from foreign wires, the suggestion that not only are telegraph and telephone wires usually the first to go down under stress of weather, but that their number is so great in many places that only extraordinary watchfulness can keep them in good condition. On the whole, the electric light wires are much less unsightly and much less likely to fail than these others which have every year become more numerous. If the electric light wires can be kept above them, a reasonably safe condition is assured.

If it were not for the fact that telegraph and telephone wires, being numerous and of no very aesthetic appearance, have usually been massed themselves on rather high poles, it would be easy to keep above them. It now requires poles often 50 feet high or more to accomplish the purpose. If a systematic effort were made to simplify all overhead wiring of every kind, much could be done in the way of averting the costly and troublesome necessity of going into conduits. Mr. Spencer's suggestion of using poles in common is often put into practice, but rarely in any complete fashion. Even trolley feeders could thus be accommodated, and when a trolley system is thus practically reduced to its necessary working conductor, such a system is altogether neat and inoffensive in appearance. In this way, too, interference with trees, often very annoying, could be reduced to a minimum. By the time a city tree has encountered the telephone lines, the electric railway feeders and the electric light wires, it needs more lives than a cat to escape destruction. By good and carefully planned work, such as Mr. Spencer lays out, extended so far as may be needful to all electrical conductors, an overhead system can be made entirely suitable for any city too small—as most cities are, and will be—to justify the cost of going to conduits. This happy condition, however, can be reached only through the hearty co-operation of all electrical interests with the municipal authorities. Nor can it be reached unless the powers-that-be deal out even-handed justice to all comers, letting none escape, instead of browbeating one with threats of conduits while letting veteran sinners continue undisturbed in their reprehensible ways.

THE MEASUREMENT OF TEMPERATURE BY ELECTRICAL MEANS.

There are two different methods of measuring temperature electrically, namely, the e.m.f. method and the resistance method. These are totally different and depend upon different properties of metallic substances. The e.m.f. method depends upon thermoelectric action. According to the electronic theory, if a certain metal, say copper, possesses a given average number of free negative corpuscles per cubic centimeter, while at the same temperature iron possesses a larger number of such free corpuscles, then, when these two metals are brought into contact the iron will tend by surplusage to diffuse free corpuscles across the mutual bounding surface at the junction, and the copper will be made negative by the reception of negative electricity, while the iron will correspondingly become positive. Since the rate of diffusion of free corpuscles increases in each metal with the temperature, so, also will the e.m.f. of the junction. In order to have a resultant thermal e.m.f. in a closed bimetallic circuit, a difference of temperature is, of course, necessary between the two junctions. Conversely, by the measurement of this resultant e.m.f., the difference of temperature becomes known. The resistance method depends upon the fact that metals increase in resistivity with temperature. According to the electronic theory, the mean free path of the corpuscles in metal diminishes as the temperature rises. This has the same effect on the electric conductivity as though the length of path remained unchanged, but the number of free corpuscles diminished. But however we try to picture the action to our minds, the fact is perfectly definite that at the standard temperature of melting ice, pure metals increase in resistivity about four-tenths of one per cent per degree Centigrade. Moreover, the rate of increase follows a straight-line law with respect to temperature up to at least moderate temperature elevations, such as 100° C. For high temperatures the straight-line law appears to be deviated from, in some metals at least.

An interesting paper on the measurement of temperature by electrical means was read at the Milwaukee Convention of the American Institute of Electrical Engineers by Dr. Edwin F. Northrup. The paper is addressed almost entirely to the electric resistance method, and suggests a number of important details in the technique of the manufacture, use and maintenance of resistance thermometers, such as go to make the difference between satisfaction and dissatisfaction in their application. In the first place a special brand of nearly pure platinum is recommended for its uniformity and relatively high temperature coefficient. Then precautions have to be taken to prevent the platinum from dissolving or absorbing metallic vapors at high temperatures. Pure nickel wire is also recommended for moderate temperature thermometers. The beautiful principle of the Kelvin double Wheatstone bridge is also recommended for use with low-resistance thermometers. In such cases the resistance coils can be made very compact, and of dimensions comparable with those of a thermo-junction. For direct reading purposes a special form of D'Arsonval differential galvanometer, called a ratiometer, is described, in which the control is magnetic instead of elastic. That is, the coils lie flat in a dissymmetrical magnetic field, such that the differential magnetic actions cause the movable system to seek a definite magnetic displacement. The three leading-in wires are arranged to exert jointly a negligible torque about the axis of pivot rotation. Some of the results reported with the various types of instruments described constitute jointly a valuable research on temperature measurement and its automatic recording.

N. E. L. A. Presidential Address.

The first portion of the address of President W. H. Blood, Jr., before the Atlantic City Convention was devoted to administrative matters. He pointed out that at the time of the Boston meeting, two years ago, the total membership was 588, while to-day it is 1,014. An increase of the dues of companies operating in the largest cities and the lowering of the dues of companies operating in small towns were suggested. He recommended the abolition of Class C—college professors—and that henceforth professors be treated as honorary members, and that no fees be exacted; that they be admitted upon invitation only, and that each case be passed upon annually by the Executive Committee. He considered that while the fellowship was desired of earnest educators for their own sake and because of the influence which they have over the hundreds of young men they are sending out each year from the technical schools, the association has no place for the instructor, with only academic ideas as to corporate management, who in his capacity as consulting engineer either ignorantly or wilfully misrepresents the facts. He referred to the central station advertising display as emphasizing the fact that "business-getting" is one of the important parts of the successful electric lighting enterprise.

The past year, he said, has shown a healthy growth of the electric lighting business, but it is not notable as having given birth to any marked innovation in the physical part of the business. The size of generating units continues to increase, distribution by high-tension alternating current is becoming more and more general, and minor improvements all along the line are extending the utility of this system. Undeveloped water powers, which a few years ago were valueless are to-day being eagerly sought out, and by means of improved water wheels and high-tension lines are being made available for large sections of the country. Gas engines, steam turbines and other prime-movers are receiving the careful attention of enterprising engineers, because we are all beginning to realize, more and more forcibly each year, that the great losses between the coal pile and the dynamo must be cut down.

There has been a marked increase in centralizing the ownership of electrical undertakings. This has benefited the communities served, by bringing to their service better managerial as well as improved operating methods. This centralization is causing electrical managers to look more closely to their markets, and to-day the company that has not a "New Business-Getting" department is sadly behind the times.

For many years by far the largest portion of the manager's time was spent in trying to better the physical condition of his plant and in reducing operating expenses to a minimum. To-day he is reaching out to supply all possible demands and through his corps of trained solicitors is endeavoring to load the plant with long-hour users of current, thus giving to the customer a low rate, while the company is better enabled to make a fair return upon its investment.

Allied with the question of rates is the problem of government supervision or regulation. This matter is demanding serious consideration at the present time. Witness the Massachusetts Gas and Electric Light Commission, which has been in existence many years, the newly formed New York State Lighting Commission and the bill just passed by the Massachusetts Legislature adopting the English automatic method of control called "The Sliding Scale System."

A study of the municipal undertakings in Great Britain and the constantly growing list of municipal failures in the United States shows that municipal ownership is, in fact, no longer as popular as it once was. Some agitation, however, is being kept alive by the socialist, by the unscrupulous political agitator and by the "yellow journal," whose whole fabric is based upon class hatred, whose teachings are that all riches come through stealing from the poor and whose very existence depends upon its ability to pervert the facts and to "fake" reports so as to make interesting reading for that part of the public loving sensation.

The proper treatment for the wilful perversion of public opinion by the press is a difficult problem. Our laws as to the deliberate publication in newspapers of false and wilfully misleading statements are not sufficiently severe. However, there still remains a powerful antidote in the hands of the public. The main support of the newspaper is its income from advertising. Its value as an advertising medium depends upon the quality and quantity of its circulation, and if those who advertise will exercise a healthy discrimination between those journals whose policies and performances are calculated to promote or to destroy the interests of their advertisers, the power for evil of some of them will be reduced.

A general reduction in price for electricity and a readjustment of rates is constantly taking place all over the country. Flat rates are fast becoming things of the past, and watt-hour meters, in conjunction with various kinds of demand systems, are now almost universally used. Although the public has been for years trying to understand the "demand" system of charging, it still objects to it, and there is a feeling in some quarters that we may have to return to the straight meter rate, which, although admittedly unjust and unfair, still has a decided advantage in its simplicity.

Along with the general reduction in rates is a lowering of the charges for street lighting, and in this connection it should be borne in mind that the lower this rate is the less liable is there to disturbance by municipal ownership agitation or by competition of any kind.

It is an unfortunate fact that, from time to time, we see in the public press erratic and even false assertions in regard to electric lighting properties. Public speakers also are altogether too prone to make unwarranted statements. Let us be more active, more aggressive to refute these unwarranted charges and by voluntary publicity of the facts as to our properties, by fair rates and by straightforward dealings with those in authority and with the public, show to all people that the electric lighting business of the United States is done "on the square."

Electric Heating in New Jersey.

Appreciating the importance of educating the general public in the use, as well as the construction of domestic electric appliances, the United Electric Company, of New Jersey, co-operated heartily with the Stevens Club, of Newark, N. J., recently, in making a success of an entertainment given in that city by that body. The lecture was delivered on that occasion by Mr. Max Loewenthal on "Household Uses of Electricity," with special reference to electric cooking and heating. A great variety of cooking and heating utensils and other domestic current using appliances were displayed on a table set on a platform.

Mr. Loewenthal sketched in a few words the development of the electric heating industry and the relation of this branch of electrical engineering to others with which the public is better acquainted and showed by a number of interesting experiments the great utility and economy of the devices which were exhibited. During the course of the lecture Mrs. Loewenthal prepared on the electric cooking utensils a complete meal. which was served to those present, who were desirous of tasting the food so wholesomely prepared. Before and after the lecture vocal selections were rendered by the Stevens Quartette. It was near midnight when this very interesting and entertaining affair came to a close.

The United Electric Company, of New Jersey, not only placed at the disposal of the club all the utensils exhibited by the lecturer, but furnished all the wiring from the nearest outlet to the various switches at the table and had special leaflets prepared which were distributed during the evening. A clever point also was made in noting on the menu the particular cooking device with which each dish had been prepared.

Canadian Electrical Trades Exhibition.

An electrical exhibition will be held at Victoria Rink, Montreal, Can., September 17 to September 22, inclusive, under the auspices of the Electrical Contractors' Association. Mr. E. W. Sayer, 204 St. James Street, is chairman of the managing committee.

The Murray Automatic Printing Telegraph System in Europe.

BY DONALD MURRAY.

The Murray automatic page-printing telegraph system has now been installed between St. Petersburg and Moscow. Some remarkably successful trials of the system have been carried out on long Russian telegraph lines. On February 23, 1906, a telegraphic loop line was made up as follows: St. Petersburg, Moscow, Smolensk, Vitebsk, St. Petersburg. The loop was triangular in shape and the length of the line was 1,106 miles (1,770 km.). The wire was 5-mm. iron (about 600 lb., 8.88 ohms per mile), and there were two Wheatstone repeating stations, one at Moscow and one at Vitebsk. The Wheatstone automatic system (using the Morse alphabet) got 55 words per minute perfectly, but failed at 60 words per minute. The Murray system (using the Baudot alphabet) under exactly the same conditions, got 90 words per minute perfectly, but failed at 100 words per minute.

On February 24, 1906, the following loop was made up: St. Petersburg, Yaroslavl, Kazan, Moscow, St. Petersburg, a distance of 1,926 miles (3,082 km.), 5-mm. iron wire (600 lb. per mile), with repeating stations at Yaroslavl, Kazan and Moscow. The speeds obtained were indefinite as one of the sections was not in good condition. The Wheatstone got about 35 to 40 words a minute, and at times a little higher. The Murray system got 56 words per minute, and ten messages were transmitted and printed. They were found to contain two wrong letters, a remarkably good result considering the condition of part of the line. This is the first time on record that a printing telegraph has worked over such a distance as 1,900 miles, even of copper wire, and in this case the wire was iron.

On February 25, 1906, a trial was made of a loop without a repeater from St. Petersburg to Moscow and back, 800 miles (1,280 km.), 5-mm. iron wire, about 7,100 ohms in the line and 800 ohms in the receiving relay, battery 140 volts, and arriving current 13 milli-amperes. The maximum speed of the Wheatstone (Morse alphabet) was 25 words per minute. The Murray system (Baudot alphabet) under exactly the same conditions got 63 words per minute easily and perfectly. Ten messages were transmitted and printed without an error.

On March 9, 1906, a trial of the Murray system was made from Berlin to St. Petersburg direct without a repeater. The length of this line is about 1,080 miles (1,728 km.). From St. Petersburg to Eydtkuhnen on the German frontier the line consists of 600 miles of 5-mm. iron wire, and from Eydtkuhnen to Berlin 480 miles of 3-millimetre copper wire (4.37 ohms per mile). The total resistance of the line was 7,425 ohms. The trial was from 8.30 to 9.30 a.m., Berlin time. Berlin tested the wire and reported that it was "not clean" (nicht rein) and wet snow was falling in St. Petersburg, where there was a thaw. After a few experiments a speed of 70 words per minute was reached perfectly with the Murray system on this line, the German typewriter sentence containing all the letters of the alphabet, "Kaufen Sie jede Woche vier gute bequeme Pelze xy 1234567890," being transmitted and received over and over again perfectly for about ten minutes. Traffic requirements did not permit of further experiments, but it is probable that by the use of a shunted condenser and increased battery power the speed might have been raised up to 80 or 90 words per minute. The highly favorable results obtained with the Murray system during these trials are explained by the inventor as being chiefly due to the employment of the Baudot alphabet, which is shorter than the Morse in the ratio of five to eight. It may also be mentioned that the inductive interference from neighboring wires was very severe on these long lines and was an important factor in limiting the speeds obtained. The Wheatstone apparatus was well adjusted by skillful mechanics, and the results were as good as could be expected from it under the conditions. Special artifices such as shunted condensers were not employed.

Whatever truth there may be in the newspaper reports about other departments of the Russian Government, the Russian telegraph service appears to be efficiently managed. Both in St. Petersburg and Moscow, the head telegraph offices were up-to-date and well equipped and arranged, and the officials hard working, capable and well instructed. The volume of messages handled in Russia is far less than in Great Britain, about 20 millions as against 90 millions per annum; but on the other hand the territory served by the Russian telegraphs is vastly greater, and the enormous Russian distances and the arctic winters have introduced special technical difficulties which have been surmounted in a way that would do credit even to American telegraphic enterprise. There is a general demand on the part of the public for an extension of postal and telegraph facilities, and there are hopes that the newly elected Duma, or Imperial Parliament, will recommend the appropriation of sufficient funds to enable these increased facilities to be provided. Meanwhile the Russian post and telegraph department has made the best use of the means at its disposal, and succeeds in bringing in a very large annual profit to the State.

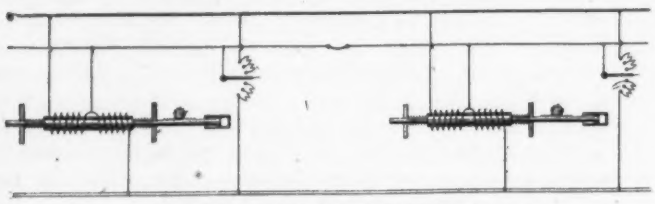
For working over moderate distances the Hughes is employed, and nearly all the long-distance circuits are equipped with the Wheatstone automatic, the received tape being handed to typewriter girls for transcription, a considerable number of typewriters being used for this purpose both in the St. Petersburg and Moscow telegraph offices. Nearly all the telegraph wires are 5-mm. iron (about 600 lb. per mile) and this fact combined with the colossal distances renders the use of an automatic system such as the Wheatstone inevitable. There are about 16 Wheatstone circuits in Russia, among others St. Petersburg to Rostov, 1,100 miles and two repeaters, Kazan and Omsk, 1,000 miles and one repeater; Omsk and Irkutsk, 1,200 miles and two repeaters; St. Petersburg to Odessa, 1,000 miles and two repeaters. From Irkutsk to Vladivostok is roughly about 1,800 miles, and from St. Petersburg to Vladivostok about 5,000 miles. The longest Wheatstone circuit in Russia is the special wire from St. Petersburg to Irkutsk on Lake Baikal. This is 6-mm. iron wire (about 800 lb. per mile), and the length of the circuit is about 3,800 miles with six repeater stations. Pekin is roughly about 1,000 miles from Irkutsk, and on one occasion the experiment was made of working through direct from St. Petersburg to Pekin. A speed of 30 words per minute was reached quite clearly, a noteworthy achievement considering that the line consists of over 4,500 miles of iron wire.

The Murray system has now been working for about two years between Edinburgh and London, and a complete duplex installation is being constructed for London-Dublin. The system has also been working for more than a year between Hamburg and Berlin, and it is working between St. Petersburg and Moscow. The Indian Telegraph Department has ordered a complete duplex equipment for use between Calcutta and Bombay, a distance of 1,200 miles, and the Austrian Administration is having an experimental set constructed for trial between Vienna and Prague. When sets have been installed between London and Berlin and between Berlin and St. Petersburg it will be possible (owing to the power of retransmitting messages automatically from the received Murray tape) for any of the cities—Edinburgh, Dublin, London, Berlin, Hamburg, St. Petersburg and Moscow (and by and by Vienna) to exchange telegrams with each other automatically without disturbing the local traffic between any two of these cities.

New Multiple-Unit Control System.

A patent issued May 22 to Mr. H. McL. Harding and Charles Martin Clark describes a new multiple unit control system, the main feature of which is the use of a single pilot wire extending throughout a train. With this single wire the motors of all the cars can be controlled to standstill, full speed forward, full speed reverse or any intermediate relation. The essential feature of the control mechanism lies in a differentially wound magnetic operating device. Assuming a solenoid with two equal differential windings in series, one end is connected to the line, the other end through the car to ground, and the middle to the pilot wire. In connection with this arrangement is a rheostat, one side of which is connected to line, the other side to ground, and the contact handle to the pilot wire.

With the rheostat handle in mid-position (where it may be on a "dead" contact) the potential of the pilot wire is 250 volts, assuming a circuit voltage of 500 volts. If now the rheostat arm is moved so as to cut out resistance on the line side, the voltage of the pilot wire is increased; and if moved in the reverse direction toward the ground side, the pilot wire voltage is decreased. When the voltage of the middle point of the solenoid is 250, at which the m.m.f's of the two windings neutralize each other, the core is held by springs in a mid-position. With increase or decrease of pilot wire voltage, this balance is destroyed, one coil carries more current than the other,



MULTIPLE-UNIT CONTROL SYSTEM.

and the core is moved in one direction or another, the amount of movement depending upon the change of voltage in the pilot wire which, in turn, depends upon the arc through which the rheostat handle is moved. It is this movement of the solenoid core which operates the motor controller. Movement of the rheostat handle in any car causes, of course, all of the motor controllers of a train to be operated synchronously to stop, start, reverse or change speed. The accompanying cut illustrates the system diagrammatically.

A. I. E. E. Presidential Address of Dr. S. S. Wheeler.

ENGINEERING HONOR.

While I have prepared in writing something of an annual address, as required by the Constitution, I shall try to express the substance of my theme to you directly, because I attach some importance to the emphasis that can be given only in this way. All that I would say has been summarized by Francis Bacon in the preface to his "Maxims of the Law" where he says:

"I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto."

I feel that I cannot make a better use of the opportunity afforded me by this occasion to reach electrical engineers and the engineering profession, nor can I do our profession a greater service, than by raising my small voice in support of the principle so admirably stated by Lord Bacon. I will use my opportunity to urge that engineers interest themselves in improving the moral standard or the ethics of the profession and in strengthening their sense of the obligation that binds all engineers to a course that is particularly honorable.

We, as engineers, are accustomed to hearing ourselves referred to as professional men. The habit of calling us professional, though not strictly accurate, does no harm, and by encouraging us to greater care and conscientiousness ought to benefit. The relations between the clergyman, physician, or lawyer and his parishioner or client are regarded by law and usage as especially sacred and inviolable, and the obligation imposed upon the professional man to be faithful to the interests of the client or protege is equally strong. It is not in my mind to dwell upon these relations or even to attempt to describe them, because they are well known and established and the subject has been treated by many great authorities.

My wish is to draw the attention of engineers and others who are engaged for the people in handling the forces of nature and in interpreting its laws, to the propriety and necessity of regarding themselves as in the same category with the strictly professional man. The attitude of the public contributes to this obligation. The public considers (much more than there is reason for) that the several branches of engineering are special subjects and not easily within the comprehension of the layman, and therefore it places itself in the hands of the engineer. He is thus put under the utmost moral and professional obligation. The duty is as great as that of the physician to his patient, although engineers as yet do not generally recognize such responsibility.

On the other hand, the public finds no such declaration of high standards in the engineering profession as in the older professions. It is therefore inclined to treat the engineer lightly in ethics, and to withhold from him that deference which, if rendered, would in itself encourage a higher professional standard.

That much thought has already been given to the subject by engineers, architects, etc., is shown by the numerous discussions which have taken place in many of the societies. The conclusions reached by many of them, as expressed in the several codes of ethics formally adopted for the guidance of members, are very interesting and helpful. I ask "leave to print" at the close of these remarks, reference to these discussions and codes, with acknowledgment for the valuable assistance of my friend, Mr. Edwin Burt Douglas.

In a few cases, however, being prepared principally with a view to the relations of the members of the profession to each other, these codes are rather narrow and in the style of labor union rules. This suggests that greater weight be given in them to the interests of the client and the interests of the public.

The electrical branch of engineering, being the youngest, has not yet formally taken up the question of ethics, but should do so and will have the aid of the experience of all other branches of the profession.

The moral duties of the engineer may be summarized as follows:

First, the duty to the client. To see that his interests are protected, that he is wisely educated, or advised as to what he ought to have. That he gets it. That information pertaining to him does not reach others.

Second, the duty to the public. To see that the public is not imposed upon by misinformation. The newspapers are full of descriptions of schemes which mislead the public and of wildcat stories that are a reflection on the engineering profession. Engineers are frequently called upon to discuss such schemes and to point out their absurdity; and are frequently unable to convince the layman that they are without merit, because the public mind is not sufficiently educated in engineering matters and because the professional standing of engineers in the community is not high enough.

Third, the duty to the engineering societies, which involves contributing to their welfare, both in time for administration and the preparation of technical contributions and discussions, and in money. There are three reasons for this obligation: first, the society represents the art or craft by which the engineer supports himself. Surely he owes it some debt; second, it is to his advantage that the branch to which he belongs should attain a position of strength and recognition, and that it should command respect for its opinions and endorsements; third, he should so conduct himself as to stand well in his society, whose members are his peers, and are therefore the men whose commendation the world will accept.

THE ENGINEER'S DUTY TO HIS CLIENT.

This is, of course, the most important obligation to be considered, and the one to which all others must give way if there is any conflict. This is the direction in which improvement in the attainment of loftier ideals, which may be expected from natural evolution as time goes on, will be most appreciated by the public, since in this direction the public is most affected. It is hardly necessary to say that the client is entitled to the very best there is in the engineer in thought and in service or execution, and I mention it only to make the statement complete. In drawing a comparison between our profession and the older or recognized ones with a view to selecting the lines along which we should try to guide our evolution and improve our standards, while I believe that the essential principles involved are the same, and that we should set our aim at as high and even a higher standard, there are some considerations which must not be neglected and which necessarily call for the employment of slightly different means in attaining the same end.

Many supposedly independent consulting engineers have affiliations with engineering or manufacturing concerns interested in the introduction and use of a particular apparatus. The engineer usually recommends the same apparatus, and its manufacturer recommends the engineer to clients. It is often held that the best engineers are subject to such affiliations, because the best are sought after and the absence of such affiliation is an indication of lack of capacity. This is not completely true, and there are many good men doing general work, though not nearly so large a proportion as of general practitioners in law or in medicine. The circumstance, however, imposes upon those who are subject to such relations the obligation to be especially careful when advising a client to acquaint him fully with the fact of such relation and to divest themselves at the moment of any influence which might bias their judgment. Their advice will then have the increased value due to their special knowledge and experience.

Another fact which differentiates engineering from other classes of professional work is that study and work for a client takes the shape of drawings and data, which are usually regarded as the property of the engineer and not of the client. Such records are often voluminous, and are an exact statement of the affairs of the client as far as they go. Obviously, the custody of such matter involves important points in the relation of the engineer and the client, and if misused the consequences to the client may be serious. Even when an engineer is on the simple basis of an employe, it is sometimes suggested that sketches and data, such as may be contained in note books, are his personal property. In this connection the fact that nearly the entire work of the engineer is reduced to and is represented by drawings and figures as stated, gives the subject great importance. Perhaps here is the greatest difference between the engineering and the other professions. There is no parallel in the so-called learned professions, and the client or patient, almost without exception, employs aid simply for experience and advice, and at no time does occasion arise for the reduction to a minute record of the preliminary or final results. In this respect moral responsibility devolves upon the engineer in greater degree than upon others. The point may well be illustrated in a more ordinary connection by considering the possibility of a manufacturer, founder or artisan, furnishing to strangers articles made from designs, drawings or patterns, the property of others which happen to be in his possession.

Professional relationship between the engineer and client in respect to its confidential nature and its inviolability is not thought to be like that of the physician or lawyer to client or patient, and is not so recognized by law. I believe the courts should so recognize it, and in any event the engineer should so regard it as applying to himself, and if anything should be even more scrupulous than the physician or lawyer. In these days most engineering is done for corporations, but while corporations are "artificial" persons, they are, nevertheless, created by the State, and therefore the State has the right to dissolve them, to examine their books, to ask questions, etc.—rights which the State does not possess in the case of individuals. While this difference between the legal rights of corporations (which form the bulk of the clients of engineers) and the legal rights of individuals (who form all of the patients of doctors, all of the charges of clergymen, and many of the clients of lawyers) is not the cause of the difference in the legal status of the engineer's confidential advice compared with the advice of the physician or lawyer, it is yet suggestive of it and throws light upon it. Therefore, engineers should be the more careful in regard to matters of confidence.

To the engineer whose work is educational and whose clients are, therefore, his students is given the opportunity to exercise at once the most direct influence for engineering honor, by his teaching. We may, therefore, expect that the profession will receive its greatest help from him.

THE ENGINEER'S DUTY TO THE PUBLIC

Is largely educational or instructive. If the public believes that engineering is a subject it is not fitted by talent or training to deal with, whether it is justified or not in this belief, is not the engineer under the strongest obligation to guide it aright? When a man trusts you, you are bound to respect the trust, or you will lose your standing. We all know that a mass of misleading, foolish and sometimes deliberately deceptive information on engineering or scientific subjects is given out, circulated and published. All of this by its ultimate failure brings our occupation into disrepute. Many engineers, when asked, reply correctly, pointing out the misstatements and errors; but how many of us try to be good teachers? How many of us take care to see that the real facts, the real situation, the real need or the real possibilities are made plain to the layman? Take an ordinary case, such as the almost daily statement that someone has invented a new motor (not necessarily electric), so powerful that trains can be run a hundred or two hundred miles an hour by it. Assume that there are ten thousand engineers in the United States, I suppose that one thousand of these say each time the subject is brought to their attention that it is absurd; that they don't believe it; that it has been tried two or three times but never successfully, etc. How many of even the thousand do you suppose take enough interest in setting the public right, to spend enough time to say that travel at any such speed is entirely a question of roadbed and right-of-way, that it is easy enough to make motors of almost any kind having power enough to pull a car or train at these speeds, but that practical roadbed conditions prohibit it, and that the most perfect track ever built is so irregular that the train would be liable to jump the track at such a speed. Those who give true educational explanations in form digestible by the laymen do their duty to the public, and do it and their profession a service. It ought to be clear to every engineer, and it probably is, that the more the public is enabled to understand the real facts, the more discriminating an audience it will become for the appreciation of really meritorious feats of engineering. At present I fear that in the public estimation, telegraphing to Mars is far ahead of getting the drydock *Dewey* to Manila. When a man who is in a position to know, either as a result of training and education, or of Heaven-sent talents, is asked, by one who does not know, any question about engineering, physics, or the laws of nature, and he does not set that man right to the best of his ability, he is shirking his duty. Possibly he is assuming that he has a patent on some of the laws of nature, or a part interest. This view would not raise him in any one's estimation.

Another example occurs to me. I have seen a man as a witness in court, after qualifying as a patent expert, which means that he is officially clothed with authority as an engineer, and that he is there for the information of the court, spend hours and even days framing numerous answers to a single question, his sole object being to avoid, if possible, making a simple statement of the truth. The mistake, of course, is that the man confuses his duties and acts as an advocate, while the public understands that he is there as an engineer to make clear the facts. The result is well known and gives rise to the saying, "Liars,—liars and patent experts." The example serves my purpose well in illustrating by extremes what I mean when I say that it is the duty of an engineer to give the public the truest and simplest explanation of each engineering question when it comes up in his community, taking care to put it in such form as will be understood.

THE ENGINEER'S DUTY TO HIS PROFESSIONAL SOCIETY.

The other duties of the engineer I have placed before his duty to his professional society, because this latter relates to his solicitude for himself and his fellow engineers as distinguished from his solicitude for his client and for the public. The principle of doing something, however, for "your crowd" is so well established and recognized that it does not need full discussion here. I think even some animals act upon this principle. The institutions of crafts, societies, fraternities, guilds and the like, is very old, and the reasons for them are sound and well known. Yet there are those who pay no attention to the official society representing the profession to which they belong. Rare and peculiar birds.

Unfortunately, some societies are at times not well run. The meetings are sometimes monotonous, owing to the presentation of matter which does not happen to relate particularly to or interest the members then present. The groups of men are not well

balanced, some being older men with wide experience, while others are the beginners, and sometimes the meeting quarters are not comfortable. None of these things is an excuse. If the profession is young and poor, so are you. If you have prospered you are a member of an important and successful profession, and then if the quarters are poor and the society not strong, it is your fault, because you have not contributed enough to make a society important in proportion to the position you have attained by work in the sphere of activity which it represents. There are many ways in which you can support, encourage, and contribute to the dignity of your professional society, and you can select those means which are most agreeable to your own methods. Even the mere attitude of approval of the society is of great value. It is well to give your profession and the public to understand that you believe in your society and follow its recommendations and standards.

A more commonplace but none the less positive reason for your obligation to contribute to the support of your society is that you are earning your living out of the art which it represents and which it is trying to dignify. Your obligation is, therefore, definite. It is also greatly to your interest that your profession be made as important and its position before the world as commanding as possible; and it would not be right were you to allow other professionals to bring about this result without your aid and then for you to reap any benefit from it.

In conclusion, I will mention what I believe to be the broadest and most important function of professional relations—an engineer's standing or the way in which he is regarded by his contemporaries. All the world recognizes that the best judgment of a workman is by other workmen, of a woman by other women, of a lawyer by other lawyers; likewise the best estimate of an engineer as a man and engineer is by the members of his own profession.

CURRENT NEWS AND NOTES.

THE WIRELESS TELEGRAPH CONFERENCE.—On the suggestion of the British Government, the International Wireless Telegraph Conference, which was to have taken place in Berlin this year, has been postponed from June 28 to October 10.

AMERICAN CIVIC FEDERATION IN GLASGOW.—The American National Civic Federation's committee inspected the Glasgow municipal electrical system on June 1. According to a dispatch the members expressed surprise at the efficiency of management and low rates for current.

PENNSYLVANIA INDEPENDENT TELEPHONE ASSOCIATION.—The next meeting of the Pennsylvania Independent Telephone Association will be held in Allentown on September 11, 12 and 13 next. Mr. H. E. Bradley, 135 South Second Street, Philadelphia, is the secretary of the association.

STATE CONTROL OF WIRES IN MASSACHUSETTS.—Governor Guild of Massachusetts has signed the bill authorizing the State of Massachusetts to assume control of telephone and telegraph wires operated within the State. The wires will be under the supervision of the State Highway Commission.

PROF. DR. OSTWALD has resigned the professorship which he held in the University of Leipzig for nearly twenty years, having decided to retire to his country house, where he has a private laboratory, and devote himself to experimental and literary work.

NATIONAL PHYSICAL LABORATORY.—The buildings which have been added to the National Physical Laboratory in London for electrotechnical and photometric work will be opened June 25 by Mr. R. B. Haldane, the Secretary of State for War. This is the first day of the tour of the members of foreign societies received by the Institution of Electrical Engineers, and they will be invited to attend the ceremony.

CONVENTION OF NATIONAL ELECTRICAL CONTRACTORS.—The National Electrical Contractors' Association of the United States will hold its sixth annual convention at Cleveland, Ohio, July 18, 19 and 20, next. Mr. Alex. Henderson, master of transportation, has just issued a circular regarding the railroad arrangements.

CONGRESSES AT MILAN EXHIBITION.—Among the congresses to be held during the exhibition at Milan this summer are the following: September 5 to 9, Electrobiology and Radiology; September 23 to 30, Engineers and Architects; September 17 to 22, International Union of Tramways and Railways, and September 17 to 21, Commercial Training. Among the congresses for which the dates are not yet fixed is one devoted to meteorology and a congress of tramway associations. The congress on automobiles was held May 24 to May 29.

COURT SCIENCE.—During a suit recently in London involving payment for electrical conductors, the counsel on both sides were not deterred by lack of scientific knowledge from plunging into technical detail. According to a London contemporary, one of them announced triumphantly that "braided wire is not a dielectric"; and another explained how dust and damp "sucked the electricity" out of a wire. An expert for one of the litigants having specified that the best materials were used, one of the counsel drew attention to the fact that brass eyelets were scheduled and asked "Isn't gold the best 'non'-conductor there is? Then why not gold eyelets; gold is better than brass." Whereupon the referee suggested somewhat sarcastically that diamonds would be better still.

INSTITUTION OF ELECTRICAL ENGINEERS.—The report of the Council of the Institution of Electrical Engineers (British) at its recent annual meeting shows that since the last annual general meeting up to May 17 inclusive, 505 proposals for election have been considered, and there have been elected 10 members, 159 associate members, 13 associates and 251 students. To the class of members there have been transferred 32 associate members and 4 associates; to the class of associate members there have been transferred 55 associates and 31 students. The change in the roll during the last 12 months is shown in the accompanying table:

	1905.	1906.
Honorary members	6	6
Members	994	1,024
Associate members	1,610	1,820
Associates	1,609	1,509
Students	1,321	1,487
Foreign members	131	127
Total	5,671	5,973

This statement is of interest in comparison with the report of membership of the American Institute of Electrical Engineers.

VACUUM TUBE REGULATOR.—Two patents were issued May 8 to Mr. D. McFarlan Moore on a means of maintaining a constant degree of attenuation in a vacuum tube. Difficulties have heretofore been met with in the operation of such tubes from variation in vacuum, and it has been necessary either to open a tube and renew the contents and then re-exhaust, or else provide within the tube some solid material which would act as a generator or regenerator of gas, to repair automatically the impaired vacuum. The present invention consists in means for automatically maintaining the vacuum in the vacuum tube at a substantially constant degree by feeding gas to the tube from a body of gas having a higher density or tension than that to be maintained in the tube. This involves the use of a feed device in the nature of a valve interposed in a passage between the tube and the body of gas of higher density. A magnet connected in circuit with the tube responds, directly or indirectly, to changes of electrical resistance accompanying variation in the vacuum. This change of strength in the magnet is employed to operate the valve in such a way as to admit more gas to the tube and thus bring the vacuum back to normal; the strength of the magnet, then decreases and the flow or admission of gas from the source is automatically cut off.

WITH REGARD TO COBALT.—Mr. Edison, who has been investigating the resources of North Carolina, states that cobalt available for his storage batteries has been found in seven counties of that State. The supply is said to have come hitherto in a limited way from Germany.

JAPANESE LUMBER ENTERPRISES.—United States Consul-General Miller, in advices from Yokohama says that important developments are about to be made with the aid of foreign capital in the timber industries in Japan. A concern has been formed with a capital of $475,000 gold, which will carry on the lumber and sawmill business in Japan, three or four mills being established in different parts of the country. The principal branch of this business will be the export trade, and Canadian engineers will be in charge of the newest and best machinery, to be driven by electricity. The capital is furnished by French, English and Japanese capitalists, and all the shares are taken by the promoters.

THE CONNECTICUT RIVER.—It is stated that the approach of the final hearing which the board of review of the War Department will hold in Springfield, Mass., this week, in the matter of opening up the Connecticut River for navigation between Hartford and Springfield has given new life to the project for a company to be formed to utilize the water power at King's Island, below the Enfield dam. Certain Springfield capitalists have been approached and it is said that the promoters plan the formation of a company to be capitalized at between $2,000,000 and $3,000,000 for the purpose of erecting the necessary dams, bulkheads and flumes. The Connecticut River company, of Windsor Locks, is reported to be behind the scheme.

SUSQUEHANNA RIVER POWER.—It is stated that Attorney-General Carson, of Pennsylvania, is working on the papers in the proposed suit to compel the McCall Ferry Power Company to stop work on the mammoth dam across the Susquehanna River at McCall's Ferry. The attorney-general claims the company has no legal right to utilize the water rights of the Susquehanna River for its own purposes perpetually and without compensation to the State or the public, and states that it is his purpose to take vigorous measures to protect the State's interests. He alleges that if this company has the right to build a dam across the river at McCall's Ferry there is nothing to prevent any private corporation from damming this or any other river and using the water rights wherever and whenever it pleases. The object of this attack is not clearly understood, as the utilization of the waste water power is said to be a popular scheme that will prove of great benefit to the community.

THE AVAILABLE COAL.—A recent estimate of the coal supply of the world by *Stahl and Eisen* gives figures particularly favorable to Germany, whose deposits are placed at 280,000,000,000 tons, which will last, at the present rate of consumption, a couple of thousand years, and in any case making allowance for probable increased demand, should suffice till the year 3000. The other European countries are given a less favorable position. The coal deposits of Great Britain and Ireland are placed at about 193,000,000,000 tons, and with an annual consumption twice that of Germany, that supply will be exhausted in less than 400 years. The estimated coal deposits of Belgium are 23,000,000,000 tons; of France, 19,000,000,000; of Austria, 17,000,000,000, and of Russia 40,000,000,000. North America's coal deposits are estimated by the same authority at 681,000,000,000 tons. The total for all Europe, adding minor supplies to the preceding figures, is placed at 700,000,000,000. But these gigantic figures are said to be dwarfed by Asia's deposits, which cannot at present be even approximately estimated. China is supposed to possess inexhaustible supplies of coal. Indeed, a German scientist is credited with estimating the deposits of the Province of Shansi alone at 1,200,000,000,000 tons. Siberia and the Island of Sakhalin are also credited with vast deposits, of unestimated extent.

ENGLISH UNDERGROUND TELEGRAPHS.—The underground telegraph cable system between London and Glasgow appears to be nearly complete. The actual length of line is only 409.5 miles, but the total mileage of wire exceeds that of any similar line. Over 37,700 miles of wire have been laid. The route followed by the cable is from London to Birmingham, then through Stafford, Warrington, Preston, Kendel, Carlisle, Beattock and Glasgow. The conduit consists of cast-iron pipes, each 9 ft. long, not including the socket, and having a nominal internal diameter of 3 in. The average diameter is 3⅛ in. The line is divided into sections about 150 yards long between Birmingham and Carlisle, and 220 yards between Carlisle and Glasgow. The pipe is laid on an average not more than 14 in. below the surface of a footway and not more than 2 ft. below the surface of a roadway. At intervals of five miles the cable conductors are led into connection boxes fitted in pillar test boxes. These boxes provide facilities for making all ordinary electrical tests, also for air-drying the cable in case the insulation becomes defective. The cable line from London to Birmingham is 117 miles long and contains 76 conductors, each weighing 150 lb. per mile.

THE SAN FRANCISCO FIRE.—Discussing the San Francisco fire, the *Electrical Magazine*, of London, says: "Judging by reports, gas seems to be mainly responsible for the outbreaks, as the bursting of the huge pipes would release many thousands of cubic feet. Had San Francisco depended solely for light and power upon electricity we are convinced the fire terror following the earthquake would never have been experienced, and much valuable property might now be still unharmed. We hope that in the reconstructed city gas will not be allowed an entrance, especially if substantial evidence is produced by which the fire can be fixed upon this particular public service. Earthquakes no man can control, but their consequences can in some measure be mitigated. Steel buildings are to be had which will withstand earth tremors, and precautions are possible to prevent conflagrations when buildings are shaken to the ground. San Francisco, before any city, is in touch with natural power sources which would, if properly applied, make it the foremost electric city in the world. Gas, coal, coke and wood fires need find no place within its walls when cheap transmitted electricity is so near at hand. Nature has stepped in and shaken this fair city of the West as if to awaken it from slumber and summon it to the task of casting out all that threatens its citizens' welfare. Let us hope her teaching will not be lost on the men whom, while she admonishes, she endows with the means of defence against the consequences of her chastisement. May we soon point to San Francisco as *the* electric city of the world."

NEW YORK TELEPHONE COMPETITION.—Mr. John M. Shaw, President of the Atlantic Telephone Company, has formally presented its two-cent telephone rate proposal to the New York Board of Estimate. The company is willing, with two exceptions, to agree to the terms proposed for the company by the Bureau of Franchises, if the city desires to operate on that basis, but if the city desires to operate on the basis informally discussed by Controller Metz and Martin W. Littleton, counsel for the company, at the recent public hearing on its application, an agreement can be reached along those lines. Mr. Shaw objects to the requirement of an initial $250,000 payment to the city and the clause allowing the city to control the capitalization of the company. He insists on $100,000 as a first payment, and wants no restrictions in regard to capitalization. He also wants the city to guarantee the right of entry to the conduits of the Empire City Subway Company. If the company can have free use of the subways it will "enter into a contract to furnish telephone service from any part of New York City to any other part of New York City at a flat rate for business purposes and unlimited service of $108 per year, and a flat rate for residences and unlimited service of $66 per year, and for such subscribers who do not wish to enter into a contract for unlimited flat rate service the Atlantic Telephone Company will agree to furnish them measured service at 2 cents a call wholly within any borough and 5 cents a call between boroughs."

TELEPHONES IN MINES.—A dispatch from Australia states that at a recent conference the mine owner of Victoria and Tasmania voted unanimously in favor of installing telephones in mines as a precaution and preventive in regard to accidents and disasters.

POST OFFICE TELEGRAPHS.—Congressman S. W. Smith, of Michigan, has introduced a bill to establish a limited telegraph service in connection with the post office department. All post offices at incorporated cities, villages and boroughs are made stations. It provides for leasing lines of telegraph companies now in existence.

INSTITUTE FOR ST. LOUIS.—It is announced that Mr. David Ranken, Jr., one of the wealthiest men in St. Louis will devote the sum of $2,000,000 to founding a school in that city on the lines of the Massachusetts Institute of Technology. The items in regard to it, however, give the institution proposed more the character of an industrial or trade school "for the benefit of those too poor to acquire special training otherwise."

A BAD FIRE starting during the day on May 26 on the premises of Zucker, Levett & Loeb Co., the manufacturers of electro-depositing apparatus and supplies on West Twenty-fifth Street, New York City, resulted in the destruction of six buildings, one death and the injury of five persons, some of the employes of the concern being included. The force of the Connecticut Dynamo & Motor Company on the second floor of one of the buildings had an exciting and dangerous time before it could escape.

DRIVING IT HOME.—In a recent general communication, the Co-operative Electrical Development Association says that one of the advertising agencies in the electrical field has already made contracts with various central stations covering advertising services which involve, during the coming year, the issuance of 459,306 pieces of advertising matter to residences, stores, business places and power "prospects," all of whom have doubtless never before received attractive advertising from the central stations. It is obvious that such a large amount of missionary work must bring definite results.

TROLLEYS IN SOUTH AUSTRALIA.—The Government of the British colony of South Australia and the directors of the Adelaide Tramway Company have arrived at an agreement for the purchase by the Government of all the tramways in the city of Adelaide for the sum of $1,362,620. The conditions are that, subject to parliamentary approval of the agreement and the shareholders' acceptance of the terms, the Government guarantees to pass the agreement during the next session of parliament and also to introduce a bill for the municipalization of the system and the conversion of the lines to electric traction. This should provide a large opening for American electrical material.

PLATINIZED ELECTRODES.—In a paper presented before the British Faraday Society, Mr. H. D. Law described some experiments made with a view to finding an electrode on which the reduction of the aromatic-aldehydes and similar easily reducible compounds could not be effected. Platinized platinum, as being the metal from which hydrogen is liberated at the lowest potential, was tried as the cathode in an acidified alcoholic solution of benzaldehyde. At first energetic reduction took place; the activity of this, however, diminished in successive experiments, and was extremely small after twelve hours' polarization. The reaction is probably catalytic in its origin. In the discussion Dr. N. T. M. Wilsmore drew attention to Tafel's work, which the author's results appeared to contradict.

ELECTRICALLY-OPERATED CABLE WINCHES.—Electric cable winches have been recently taken into use by the German telegraph department in connection with the laying of underground cables that are being substituted throughout for the overhead lines. The process followed in laying these underground conductors consists of first constructing cement ducts. Hitherto the insertion of the cables was made by hand, requiring the work of 10 to 12 men. The electrically-operated cable winch which replaces this hand operation, is distributed over two cars, viz.: a smaller car on which the electricity to operate a motor is generated by means of a benzine engine of 6 hp capacity actuating a dynamo, and a larger car containing the 3-hp motor and the winch. The latter is provided with a self-acting cut-out switch, in case of an excessive strain. The tension on the cables is thus most accurately regulated, a result quite unattainable in the case of a direct-acting benzine engine. The heaviest cable 200 meters in length, is hauled in in about 7 minutes.

NOVEL USE OF THE FAN MOTOR.—The fan motor has proved useful in the ventilation of store windows since the earliest days of its commercial availability, but the arrangement of two 16-in. electric fans in a Boston shop window to display the attractions of about 50 toy balloons is a new suggestion. Streamers of ribbon have often been displayed with a fan motor, but in the case above mentioned, a beautiful effect was produced by setting the two motors at the opposite lower corners of a large window and setting free some 50 gaily colored toy balloons in the window face. The balloons followed the air currents up and down, sweeping through long fascinating curves like huge bubbles, and a large crowd was drawn in this way to appreciate what the concern had for sale in the balloon line.

IOWA STATE COLLEGE THESES SUBJECTS.—Following is a list of the subjects of theses presented by the graduating class of Iowa State College, Ames, Iowa: J. L. Anderson and C. A. Peterson, "Test of the Nevada Electric Lighting Plant"; R. W. Atkinson and J. W. Patch, "The Effect of Insulation Upon the Carrying Capacity of Wires"; R. I. Caughey, "A Study of Tin-Lead Alloys as Solders"; L. E. Coates, "Design of an Alternating-Current Railway Motor"; D. H. Cogswell and A. M. Weise, "Fuse Tests"; W. D. Elwood, "Plans and Specifications for Telephone Plant"; L. S. Ickis, F. T. Rowat and Ed Reese, "Comparison of Methods for Mean Spherical Candle-power Measurements"; F. A. Johnson and Max Nelson, "A Study of Telephone Line Disturbances and Their Prevention"; E. N. Jory, "Design of an Alternating-Current Equipment, Ames & Des Moines Railway"; G. R. Kenny and W. A. Marsden, "Design and Construction of Synchroscope"; W. G. Rubel, "Test of the Ames Electric Lighting Plant"; H. V. Nye and T. R. Williams, "Design of an Induction Motor"; K. R. Ogden and C. G. Throckmorton, "Design of a Lighting Plant for Chariton, Iowa"; H. M. Smith, "Design of Gas and Electric Lighting Plant."

TAXATION IN WASHINGTON.—Advices from Washington, D. C., state that taxation at the rate of 12 per cent of the net earnings of the street car, gas and telephone companies doing business in the District of Columbia is the feature of a bill reported favorably to the Senate by the Committee on the District last week. The measure, which was the product of the sub-committee which had framed it, met with vicissitudes in the Senate, however, and was referred back to the committee for further consideration. What its ultimate fate will be, with the chairman of the committee opposed to it, is problematical. Senator Hansbrough, chairman of the sub-committee which prepared this measure, states that this committee made a most searching examination of the records of these companies and of similar companies in other cities, and determined that a 12 per cent tax on the net earnings of Washington companies would result in their paying almost the same rate of taxation as is now paid by private individuals. There are six railroad companies and one gas and one telephone company involved, and taking their net earnings for 1905 as a basis, it is said to be found that had the proposed law been in operation then they would have paid $400,000 into the District treasury. The committee in its investigations found that the trolley companies of Baltimore paid taxes amounting to 20 per cent of their gross receipts, in addition to the regular tax on all real and personal property.

The Electrical Transmission System of the Long Island Railroad.

OUR issue for November 4, 1905, contained a description of the main features embodied in the electrification of the Long Island Railroad, and information concerning the general arrangement of the large power house of the Pennsylvania Railroad, which supplies electric energy to the L. I. R. R., was given in our issue for January 7, 1905. We are able to supplement these accounts by more detailed descriptions of the electrical transmission system.

GENERATING SYSTEM.

Following is a brief resumé of the generating system. The arrangements for electrification as planned by the Pennsylvania Railroad include tunnels under the Hudson River, New York City and the East River in order to connect its tracks with those of the Long Island Railroad at its terminal to be established in the heart of New York City between 31st and 33d Streets and 7th and 9th Avenues. There will be two main generating stations, one of which will be located in New Jersey and the other near the East River in Long Island City. Short descriptions of the latter generating station were given in the articles referred to above.

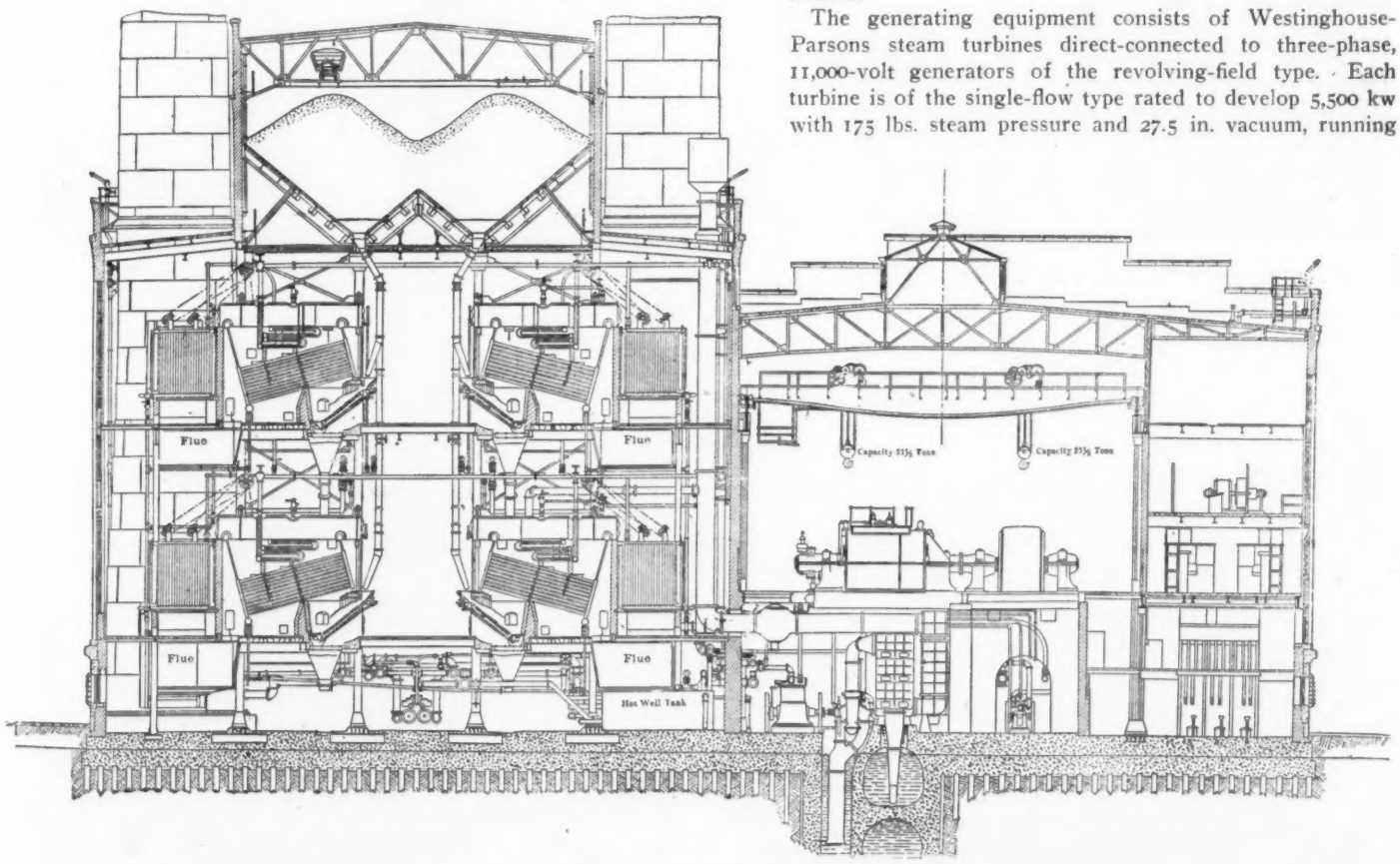


FIG. 1.—SECTIONAL ELEVATION OF POWER STATION.

This station contains at present three 5,500-kw steam turbines and generators, a size which has been adopted as standard for future work. The station is designed so that it can accommodate within its present walls six generating units of this size and two of 2,500 kw for lighting the tunnels. The ultimate capacity when extended will be about 105,000 kw in electrical machinery. The over-all dimensions of the present building are 200x262 ft., outside measurement. The boiler house is 103 ft. wide inside, the engine room 66 ft., and the electrical galleries 25 ft. wide. The boiler house proper is 82 ft. high to the top of the parapet. The coal pocket enclosure, superimposed on the boiler house, is 60 ft. wide, and its parapet is 118 ft. high. The turbine room is 70 ft. high to the top of the parapet. The superstructure of the building consists of steel frame work. A sectional elevation of the station is given in Fig. 1.

The location of the power station is such that it can receive coal either by water or by rail, but the plant was designed more particularly to deal with coal carried to the station in barges. The ash and coal conveying equipment consists of three parts, a coal hoisting tower, a cable railroad for conveying the coal from the tower to the coal pocket, and an ash bin structure. The top of the hoisting tower is 170 ft. above the dock, making it the highest hoisting tower in existence. The tower has a capacity for 400 tons of coal in five working hours. It is operated by Lidgerwood steam engines located in an engine room at the base of the tower.

The boiler plant consists of 32 Babcock & Wilcox water-tube boilers set in batteries of two boilers each, eight batteries being on the first floor and eight on the second floor immediately above. The boilers are designed for a working pressure of 200 lbs. per square inch, and they are supplied with superheaters capable of superheating the steam by 200° F. Each boiler is fitted with a Roney stoker, the bars of which are rocked by a Westinghouse steam engine, there being one engine to eight stokers.

The generating equipment consists of Westinghouse-Parsons steam turbines direct-connected to three-phase, 11,000-volt generators of the revolving-field type. Each turbine is of the single-flow type rated to develop 5,500 kw with 175 lbs. steam pressure and 27.5 in. vacuum, running at 750 r.p.m. The bearings of the turbines, which are water-jacketed, are supplied with a forced circulation of oil.

Each turbine is provided with a separate condenser placed in a large arched opening made in the turbine foundation. The vacuum pump for each condenser is driven by a horizontal engine with Corliss valves and automatic governor on the steam end and positive-motion valves on the vacuum end. In order to prevent the deterioration of the condenser from the salt condensing water forming a convenient path for stray electric railway return currents, a shunt circuit is provided between the incoming water pipes and the condenser flume for the purpose of diverting as large a portion as possible of the current from the condensers. A small booster-generator, which is connected in the shunt circuit, serves to neutralize the effect of such current as might still leak past the insulating joints which are inserted in the water main.

Three separate sources are provided for supplying current to the field coils of the main generators, namely, two steam-driven exciters, one motor-driven exciter, and a storage battery. The

storage battery, which is intended mainly as an absolutely reliable source of supply for the exciter-bus system and the other more important auxiliaries, is normally kept "floating" across the exciter bus-bars.

The generators are designed to operate in parallel on either of two sets of main bus-bars, called the "working" and the "auxiliary," only one set of which is generally in use. The cables are run through the turbine foundations into the basement, then to the main generator circuit-breakers which are

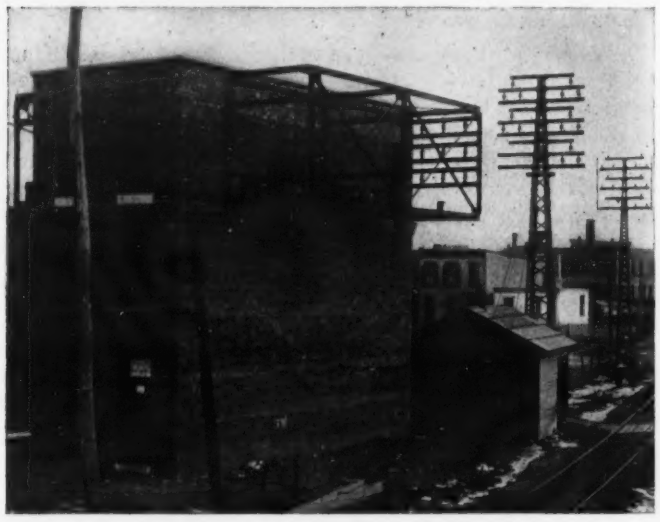


FIG. 2.—ARRESTER HOUSE AT DUTCHKILLS STREET.

placed on the feeder gallery. All of the circuit breakers have remote electrical control, and are worked from the main operating gallery on the upper floor. Each pole of a circuit-breaker is enclosed in a separate fireproof chamber of brick, capped with a slab of alberene stone upon which the operating gear is mounted. These switches are operated through solenoids actuated by current received from the auxiliary bus-bars.

TRANSMISSION SYSTEM.

The feeder cables connecting to the high-tension transmission system are of the three-conductor type. They pass through ducts, laid in the floor of the basement gallery, which lead to a manhole directly outside of the building. The transmission circuits pass from this manhole in conduits through a portion of Long Island City, and then connect to overhead lines.

The lengths of the various sections of the transmission lines are as follows: Conduit section of trunk line, power station to Dutchkills Street, 1.12 miles. Overhead trunk line, Dutchkills Street to Woodhaven Junction, 7.85 miles. Conduit section

FIG. 3.—CONDUIT CLOSE TO TRACK, SHOWING FORM OF DUCTS USED.

from Woodhaven to East New York, 3.23 miles, and from East New York to Grand Avenue, 3.04 miles; Woodhaven to Dunton, 1.7 miles. Overhead from Dunton to Rockaway Junction, 1.73 miles, Rockaway Junction to Springfield Junction, 3.35 miles, Springfield Junction to Valley Stream, 2.57 miles. Woodhaven Junction to Hammel, 6.98 miles. The total length of conduit lines now in use is therefore 9.09 miles and that of pole lines 26.19 miles.

Conduits.

The major portion of the route of the conduit line connecting the arrester house (Fig. 2) at Dutchkills Street with the power station lies along the edge of the railroad right

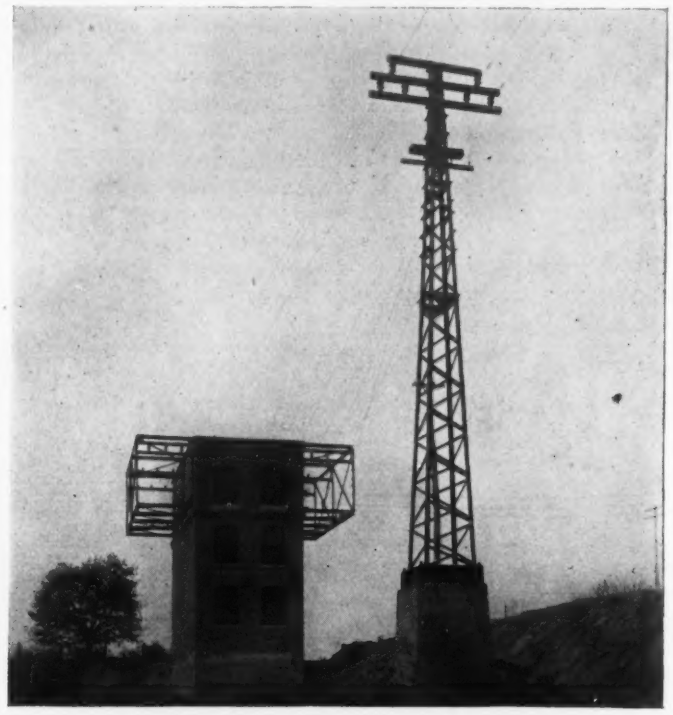


FIG. 5.—CIRCUIT-BREAKER HOUSE AT DUNTON.

of way, as shown in Fig. 3. Much of it is situated below the level of the ground water, so that special provision for the drainage of the ducts and manholes was necessary. This conduit line is so pitched as to bring all of the drainage into three sumps, from which it is removed by automatically-controlled,

FIG. 5.—CIRCUIT-BREAKER HOUSE AT DUNTON.

electrically-driven, submerged centrifugal pumps which discharge into the city sewer system.

The conduit is constructed of single vitrified clay ducts 18 in. long, with square holes 3 13/16 in. inside measurement and walls ¾ in. thick. The ducts are laid in cement mortar, and are arranged three wide and six high. Manholes for drawing in and splicing the cables are located 400 ft. apart on straight work, and a shorter distance on curves. The standard manhole for straight line work is 8 ft. long, 4 ft. wide and 6.5 ft. high, inside dimensions.

The conduit system on Atlantic Avenue comprises two kinds of construction. For a distance of 4.4 miles a construction identical with that described above is used. The other portion is built up of four-way vitrified clay duct 36 in. long with square holes 3⅜ in. on a side. The manholes along the subway portion of the Atlantic Avenue improvement consists of niches in the side walls, 5 ft. wide, 8.5 ft. in length and 15 ft. high. These manholes are accessible from the street through regular manhole openings, and can also be reached from the subway. On the other portions of the Atlantic Avenue improvement the manholes are built of concrete, and are generally oval in form, 7 ft. long, 5 ft. wide and 6.5 ft. high.

Cables.

Each of the conductors of the high-tension, three-conductor underground cables has a cross-section of 250,000 circular

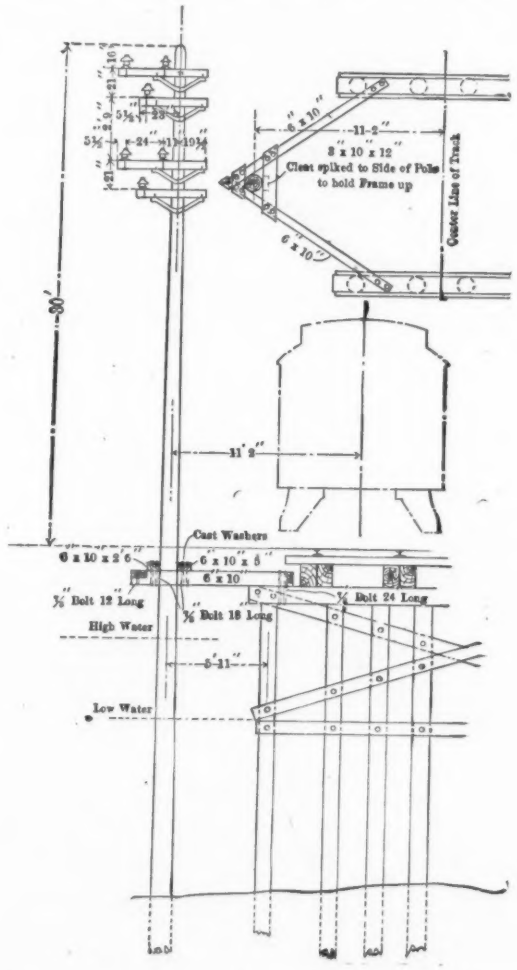


FIG. 6.—HIGH-TENSION POLE CONSTRUCTION AT TRESTLE.

mils, and is composed of 37 copper wires. Each conductor is covered with a wrapping of impregnated paper 7/32 in. thick, and a 7/32-in. layer of paper is wound over the whole group, the interstices being filled with jute. The completed cable including a 9/64-in. lead sheath has an external diameter of 2⅞ in. After the cable was ready for service it was tested for a period of 30 minutes by 30,000 volts between each pair of conductors and 27,000 volts between each conductor and the sheath.

At the drawbridges in the Jamaica Bay trestle the cables are of the armored submarine type, the conductors being insulated with 7/32 in. around each strand and 7/32 in. of rubber around the group of three. The insulation is composed of 30 per cent of pure Para rubber. The sheathing is of lead 9/64 in. thick, and over this is an armor of No. 4 B. & S. galvanized-iron wires laid spirally with a thin layer of jute between the sheath and the armor. There are two such cables at each drawbridge. The cables are laid across the channel and allowed to settle to the bottom. They were then sunk into the mud by means of a water jet, supplied by pumps at 100 lbs. pressure.

There is in all about 25 miles of high-tension underground cable installed, in addition to .418 miles of armored submarine cable.

Wherever the underground cable section of the transmission

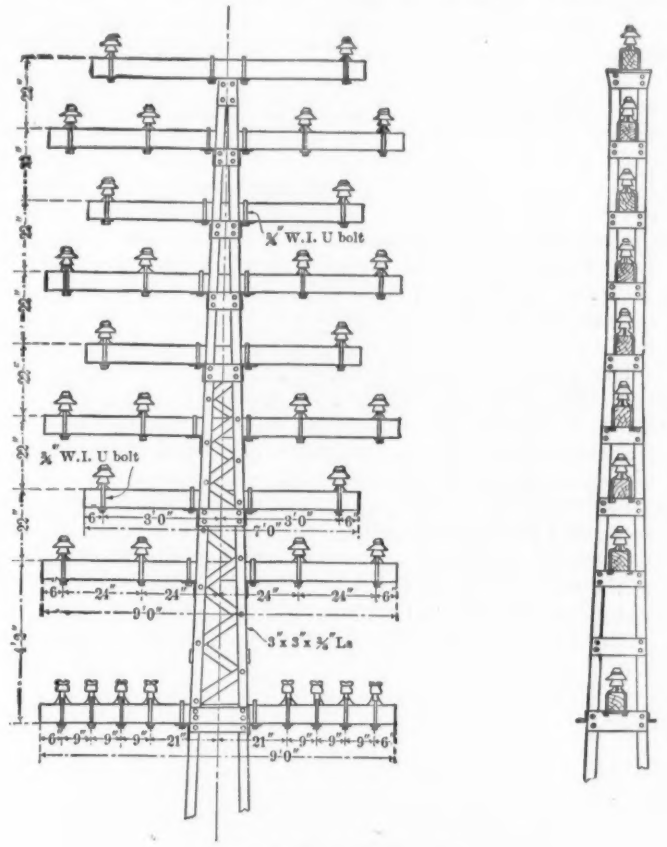


FIG. 7.—TOP OF STEEL POLE.

line is joined up with the overhead system, lightning arresters and choke coils are installed. Suitable houses are provided to shelter this apparatus, there being one on the main transmission line at Dutchkills Street, Long Island City (Fig. 2), and another at Dunton, on the branch line running east of Wood-

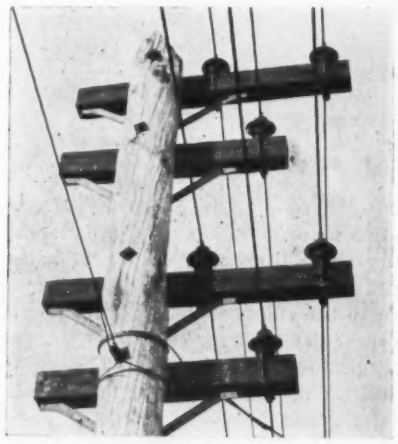


FIG. 8.—TOP OF WOOD POLE, SHOWING INSULATOR PINS.

haven (Fig. 4). Smaller houses were also provided for the same purpose at the two drawbridges.

Overhead Lines.

The overhead line construction is of the most substantial character. Over the main portion of the route the poles are of steel, but between Ozone Park and Hammel they are of wood, and wood poles are also used on the branch lines from Rockaway Junction to the separate outlying substations. The trunk line is designed to carry eight three-phase transmission circuits consisting of three 25,000 c.m. cables each, together with eight low-tension cables each. The latter are placed 25 ft. above the

ground. The branch lines are designed to carry not more than two three-phase transmission circuits and four low-tension cables on a single line of poles.

The spans between steel poles average 150 ft. in length, except where turning corners or carrying the cables over railroad tracks. The poles are built of four corner angles connected together by angles and plates forming a lattice type of construction. They are tapered uniformly to the top on two sides and to within about 7.5 ft. of the top on the other two sides, the taper being ⅜ in. per foot. This taper is the same for all lengths of poles. In each case the top measures 6 by 11 in. At the bottom the corners are tied to a base composed of plates and channels through the corners of which four anchor bolts pass. The standard poles are made in four lengths, increasing by 5 ft., from 39 ft. to 54 ft. in length; the 39-ft. pole is the type generally employed, the other poles being used only where necessary.

The poles are designed to withstand a side pressure corresponding to a wind velocity of 100 miles per hour, that is, about 27 lbs. per square foot for the flat surfaces of poles and cross-arms, and 13.5 lbs. per square inch for the projected area of cylindrical conductors.

For standard straight line poles, without side strains other than wind pressure, the corner angle irons are 3x3x⅜ in. For the heavier strains at curves and corners, the general design of the poles is the same, but they are given greater strength by using heavier corner angles.

The design of the poles for curves was made dependent on

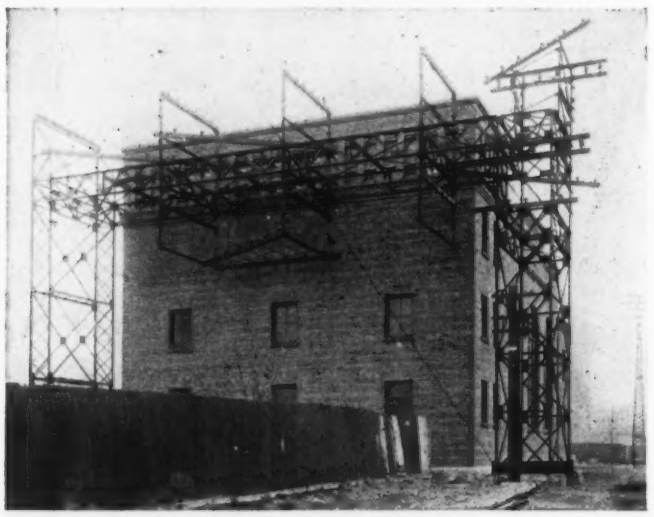


FIG. 9.—TERMINAL CABLE RACK AT ROCKAWAY JUNCTION.

the distance by which the pole is offset from a straight line joining the two poles on either side of it. For offsets up to 6 ft., the corner angle irons are 3.5x3x7/16 in., while for offsets between 6 and 10 ft., the angle irons are 3.5x3x.5 in.

In addition to the standard poles above described, which were designed to meet the ordinary conditions, an extra heavy strain pole was designed in three lengths. (See Fig. 4.) This type is used for offsets up to 32.5 ft., for turning sharp corners, and for anchoring the line at special points. These poles are similar in design to the standard poles, but the taper is increased to ½ in. per foot, and all four sides taper uniformly all the way to the top, which is 8.5x12 in. The strain poles used for anchoring are guyed fore and aft to the bases of the adjacent poles with 7/16-in. galvanized-steel cable.

The ability of the steel pole to act as a lightning rod is turned to advantage, and each pole is thoroughly grounded to a copper plate beneath the foundation and connected to one of the anchor bolts by a copper wire.

The poles were transported from the steel works without "knocking down," and were erected whole on their foundations with the aid of a gin pole. After erection, cement grout was run underneath the base and the pole was permanently set by tightening the foundation bolts. There are now in position in the line 358 of the standard straight line and curve poles, and 19 of the heavier type of strain poles.

The wooden poles are of two kinds: Chestnut, which is the standard for ordinary work, and creosoted yellow pine, which is used only along the trestle over Jamaica Bay. The chestnut poles are 45, 50 or 55 ft. in length, and 25 in. in circumference

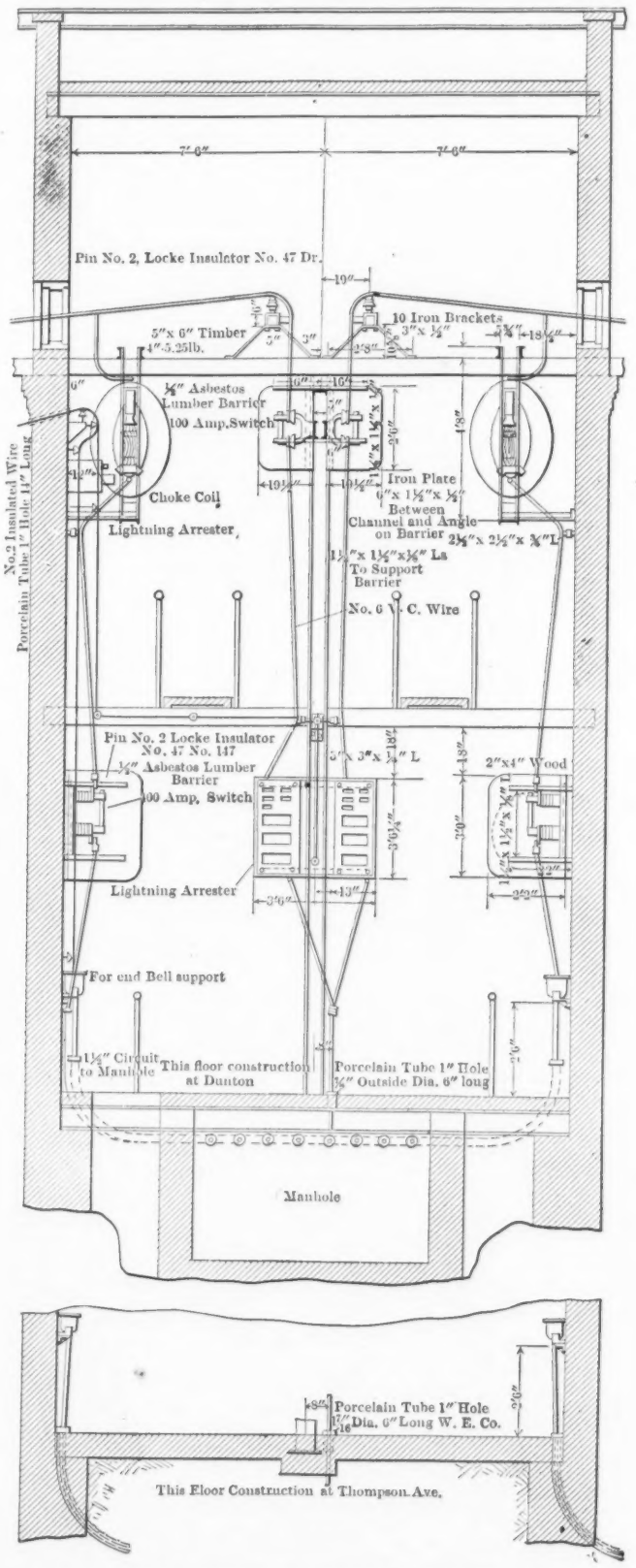


FIG. 10.—CROSS-SECTION OF LIGHTNING ARRESTER HOUSE.

at the top. The creosoted poles are from 60 to 80 ft. long, with 25-in. tops; they were treated with 15 lbs. of dead oil of coal tar per cu. ft. of timber. Each creosoted pole was set 15 ft. into the bottom of the bay by means of a water jet, so as to have its top 30 ft. above the rails. Each pole was braced to the

trestle with creosoted yellow pine timber. (See Fig. 6.) The total number of chestnut poles employed is 490, and of creosoted yellow pine poles 204.

The cross-arms are of yellow pine, 5x6 in. cross-section housed on top to a 12-in. radius, and they are painted with one coat of asphaltum paint. On each steel pole the cross-arms pass through the pole structure, and are bolted in place on seats formed of angle irons, as shown in Fig. 7. On each wooden pole the cross-arms are gained one inch into the pole, and held in place by means of through bolts and angle-iron braces.

The insulator pin consists of a malleable iron casting clamped to the cross-arm by means of V-bolts threaded through the body of the pin, and held by a plate fitting over the V-bolts and against the cross-arm, as shown in Fig. 8. This type was first used on this transmission line, and represents a new departure in pin design, inasmuch as by its use all boring of the cross-arm is avoided, and the pin used possesses a maximum of strength.

The straight line insulators are 6.5 in. in diameter and 5 in. high, made of porcelain in two parts cemented together. The tests to which they were subjected by the manufacturers, included an artificial rain test at 30,000 volts, and a salt water test at 50,000 volts for two minutes. After the insulators were erected and the cables strung upon them ready for operation, they were tested by applying 30,000 volts between the conductor and the ground for 4 minutes. The insulators were secured to the pins before erection by means of a cement composed of litharge moistened with a mixture of glycerine and water.

FIG. 11.—BROAD CHANNEL ARRESTER HOUSE.

The transmission cables are of 260,000 c.m. stranded copper, and are fastened to the insulators with ties of No. 6 copper wire 3 ft. long. The cables were strung for the most part by means of teams of horses running lines of 1,000 ft. or more in length, the cable reels being mounted on stationary racks. On the trestle, however, this method could not be so readily followed, and the cables were strung in the following manner: The reel of wire was carried on a flat car, upon which was placed a boom capable of being swung sidewise to the position which would be occupied by the wires. At the end of the boom was a snatch block through which the wire passed and by which it was guided on the cross-arm. The car was moved along slowly by the locomotive and the wire paid out, the boom being raised at each cross-arm so that the wire would drop down on to the arm. This method proved very economical.

Sub-Stations.

At the Woodhaven and Rockaway Junction sub-stations, special terminal poles or racks are provided to distribute the overhead circuits along the face of the building parallel to the high-tension switching galleries in such a manner that the disposition of the cables after entering the building will be most convenient. An idea of the method by which the requirements were met is best given by a view of a cable rack, as indicated in Fig. 9, which shows the terminal pole at Rockaway Junction. The location of this sub-station is such that the entering circuits coming from the west had to be taken around to the east side of the building and distributed from the rack there situated. The entering circuits are kept on the west side of the cable rack next to the building, while the outgoing circuits, which continues eastward, are kept on the east or outer side of the rack, thus preventing crosses and making it possible for either set of circuits to be repaired independently of the other set.

At the large lightning arrester houses, the terminal cable racks are integral with the building framework, and project from the side of the building. All circuits are carried with the cables in a horizontal plane, the uppermost circuits run to the rear end of the rack, jumpers being used to couple up to the interior apparatus. The arrangement of the equipment of an arrester house is shown in Fig. 10.

In Fig. 11, of the lightning arrester house at the Broad Channel drawbridge on the Jamaica Bay trestle, is shown the method of anchoring the longitudinal strain of the high-tension line. This anchorage consists of a tower-like structure of four creosoted poles latticed and braced together with heavy timbers, the cables being dead ended on standard strain insulators in a horizontal plane. Jumpers pass down through the inside of the tower and across to the lightning arrester house where they are connected to the submarine cables. This construction is strong, self-contained, and extremely simple, and it enables side and end guying to be dispensed with.

Operation.

The operation of the transmission line, which was first put in service on April 27, 1905, has been remarkably free from interruptions. The line has demonstrated its effectiveness as a substantial and reliable transmission system for a suburban railroad on whose regularity of operation thousands of people are daily dependent.

The design and construction of the system was carried out by Westinghouse, Church, Kerr & Company, engineers for the Long Island Railroad Company. The entire work was under the direction of Mr. George Gibbs, chief engineer of traction of the Long Island Railroad, subject to the approval of an electrical committee, consisting of the chief operating officials of the road, with the president as chairman.

Self-Synchronizing of Alternators.

A paper by Prof. Morgan Brooks and Mr. M. K. Akers, read at the recent Milwaukee convention of the American Institute of Electrical Engineers, described a convenient method of placing alternators in parallel without causing the circulating current to exceed a certain desirable limit. Instead of directly closing the switch between two machines and thus subjecting them to a possible impulsive rush of current if the machines are not in the proper phase positions and revolving at the proper speeds, an inductance without an iron core was inserted between the two alternators. The inductance prevented a dangerous rush of current even at maximum difference of phase, and yet the current which did flow produced an adequate synchronizing force to draw the machines into step.

The experiments were conducted with 60-cycle current and the results were very satisfactory. The circuit between the machines could be closed while the machine to be brought into step was at a standstill; when the speed was approximately synchronous, it would automatically fall into step, after which the excitation could be adjusted and the inductance cut out.

In the case of a synchronous converter, started from the direct-current side, the use of coreless inductance to permit the closing of the connecting switch at any instant was sometimes found to cause the converter to race as a direct-current motor, owing to the weakening of its field and consequent increase of armature current. This objectionable tendency was overcome by the use of a second inductance connected in series with the direct-current armature and additional to the starting box.

The Lighting of Churches.

A paper dealing with the lighting of churches was presented at the annual convention of the American Institute of Electrical Engineers, at Milwaukee, by Mr. Edwin R. Weeks. After having outlined the defects which characterize the illumination of ecclesiastical structures, the author stated that the chief requisites in church lighting are adequacy and uniformity. The maximum variation throughout the auditorium should not exceed 20 per cent. This uniformity is seldom secured with daylight, but there is no reason why it should not be attained with artificial light, since electricity can easily be transmitted to all parts of the building and practically moulded to suit the demands of distribution as well as the needs of the architecture and decoration. In this respect the electric light may be said to "beat daylight."

The amount of light in the reading plane should not be less than two candle-feet; that is, about twice the light required by the average person for reading without the impairment of eyesight. The frugal vestryman may ask: "Why double the amount of light?" The answer is that the best and most attractive lighting is not only an excellent advertisement and a means of grace, but it may be quite economically employed in assembly rooms which are occupied only six or eight hours each month, if the controlling devices be properly designed and used. Furthermore, a religious gathering, more than any other concourse of people, contains persons of all ages, many of whom have failing eyesight. With an expense of two dollars an hour for an illumination which gives perfect satisfaction to every one in the audience, and makes of the auditorium a beautiful and attractive place for young people, there can be no question of extravagance.

There are two general systems of interior illumination, the indirect and the direct. In the indirect system, the lamps are entirely concealed from view and their light is distributed by means of reflecting or diffusing surfaces. The installation of this system is costly, and uniform distribution is difficult. In the direct system the lamps are so placed that though they may be seen they are not in the usual line of vision. The installation by this method is less costly, and its operation much less wasteful, since nearly all of the light emitted does useful work. It also facilitates uniform distribution, and lends itself more readily to decorative effects and the expression of symbolism.

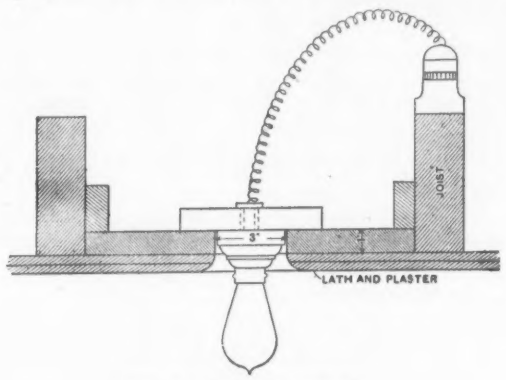


FIG. 2.—CEILING OUTLET.

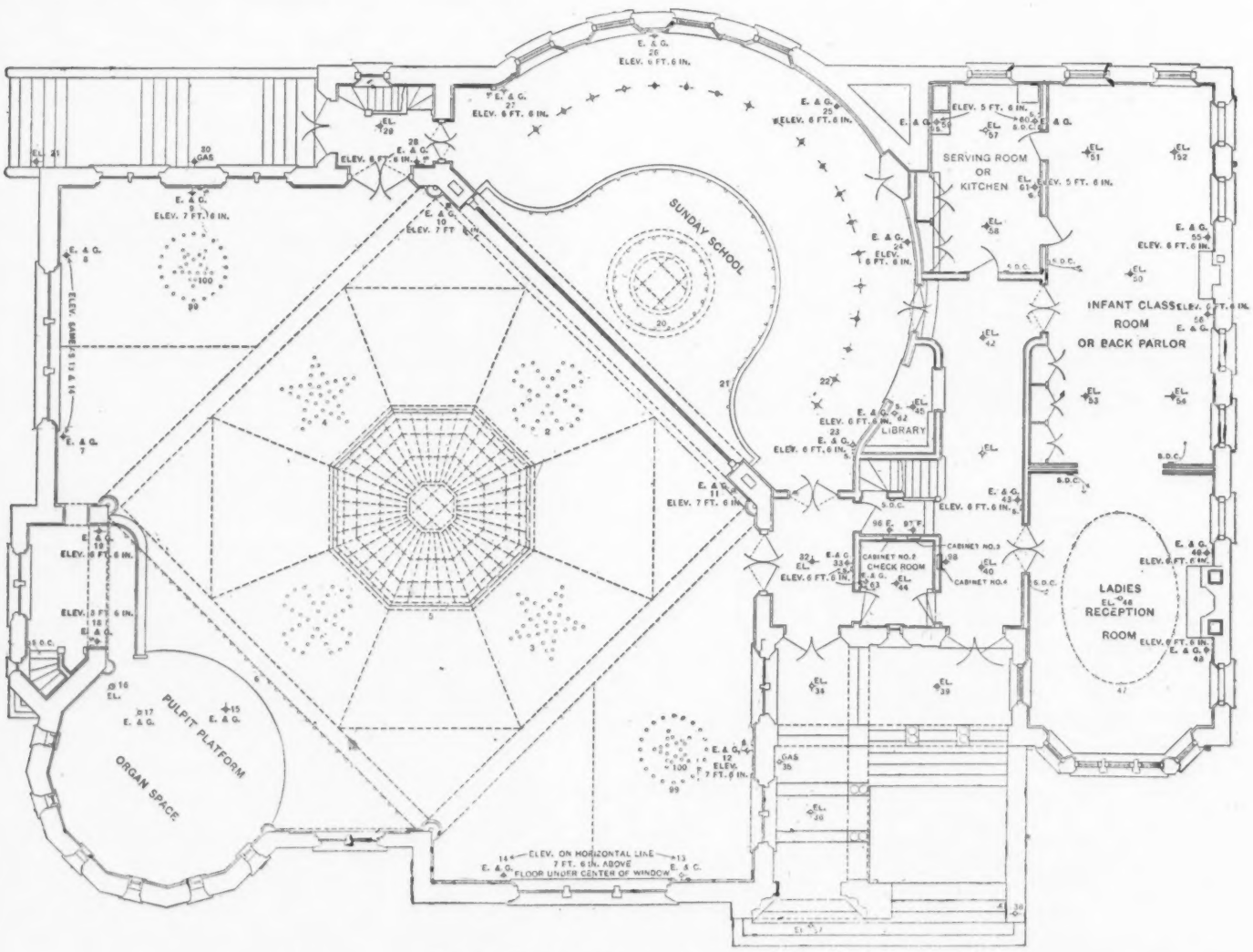

SUNDAY SCHOOL
SERVING ROOM OR KITCHEN
INFANT CLASS ROOM OR BACK PARLOR
LIBRARY
CHECK ROOM
LADIES RECEPTION ROOM
PULPIT PLATFORM
ORGAN SPACE
ELEV. ON HORIZONTAL LINE 7 FT. 6 IN. ABOVE FLOOR UNDER CENTER OF WINDOW

FIG. 1.—PLAN OF CHURCH LIGHTING.

The accompanying illustrations may serve to show the application of these principles to a case wherein the expenditure is to be moderate. The results are a good distribution of light and a satisfactory illumination in each room. All parts of the auditorium are visible; each seat receives a minimum of two candle-feet, and the variation is less than 20 per cent. No more conclusive justification for the degree of control and lighting here pro-

vided for could be desired than the enthusiastic commendation of the parishioners, and the fact that the monthly bills for electricity at the rate of 10 cents per kw-hour, with the usual church services, and including that used for the organ motor, range from $15 to $23.20.

The installation is three-wire, with neutral equal to the sum of the outside wires, and with 104 volts on each side; the drop inside the entrance is slightly less than 2 per cent with full load. The entrance switch, fuses and watt-hour meter are mounted on slate bases in a fire and dust-proof box in basement. All cabinets have white marble backs and sides, beveled plate glass doors, trims of polished wood and are set flush with the finished walls.

Cabinet No. 1, which is in the basement corridor, in addition to fuses, contains five triple-pole, single-throw knife switches; one to control each of cabinets II, III and IV, one on feeders for future use in proposed assembly rooms in the basement, and one on feeders to supply lamps, not yet installed, for lighting the stained glass over the auditorium dome.

Cabinets Nos. II and III, which are in the south passage on the main floor, in addition to fuses, each contains 20 double-pole, single-throw knife switches, 10 on each side of the system, controlling circuits supplying the ceiling outlets in auditorium, schoolrooms, main entrances, vestibules, corridors, cloakrooms, young people's assembly rooms and parlors.

Cabinet No. IV, which is in the main corridor, contains cartridge plug fuses to protect 16 circuits, 8 on each side of the system, supplying choirrooms, organ loft, pastor's study, kitchen, closets, boiler room and coalroom, brackets in the auditorium, schoolroom, vestibules, corridors and parlors, and lamps in all parts of the building intended for use at times when full lighting is not needed.

The lamps over the pulpit platform (see outlet No. 6 on Fig. 1) being back of the pulpit arch, are not visible from the auditorium, and furnish over 2 candle-feet on the pulpit, console and music rack. The outlets in the ceiling of the auditorium are so constructed (Fig. 2) that the lamps may be drawn up into the attic for cleaning or renewal.

The bracket lamps are used when light is needed only in certain places as for choir practice, janitor's work, pastor's study, etc., and are not a part of the general illumination, which is always from above.

In the wall and ceiling decorations deep cream predominates, and the designs for all fresco work in the building have special reference to the location of the lamps, and the figures employed in their distribution.

Characteristics of Mercury-Vapor Apparatus.

The fundamental characteristics of the Cooper Hewitt types of lamps and converters were outlined by Mr. Percy H. Thomas in a paper read at the annual convention of the American Institute of Electrical Engineers at Milwaukee, Wis. It was shown that the voltage consumed in the mercury-vapor lamp consists of three parts more or less different in character; that is, the vapor loss, the positive electrode loss, and the negative electrode loss. The voltage loss in the vapor is directly proportional to the length of the vapor and inversely proportional to the diameter of the vapor path. It increases with increase of vapor pressure, and more or less closely in proportion to this pressure. The voltage loss varies only slightly with a change in the current strength, as shown in Fig. 1, which represents the voltage-current characteristic of a 3.5-amp. lamp. This curve indicates the total voltage across the apparatus, but virtually represents the resistance of the vapor, plus a constant loss of perhaps ten volts at the electrodes.

The loss of voltage which occurs at the positive electrode is practically independent of the current strength. It frequently has a value of more than five volts. A similar loss of about four volts occurs at the negative electrode during normal operation. Both of the electrode voltage losses together with the abnormal negative electrode starting resistance were discussed at length.

The specific consumption of a mercury vapor lamp, which in a long tube is as low as ⅓ watt per candle (exclusive of resistance losses) is obtained only with the proper vapor pressure, current and tube diameter. The consumption has a minimum at a certain pressure, and it is nearly independent of the current strength within certain limits. Superheating that portion of the vapor emitting light seems to have little effect on the consumption.

The principle of the alternating-current lamp is generally well understood by this time, the circuits being shown in Fig. 2. Referring to this figure it is evident that during one alternation

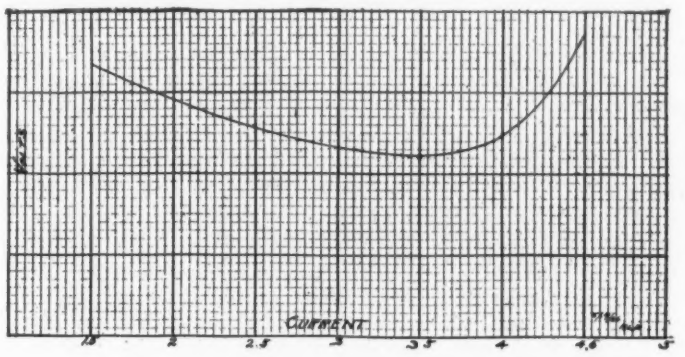


FIG. 1.—RELATION BETWEEN CURRENT AND VOLTAGE ACROSS A DIRECT-CURRENT LAMP.

current is supplied from one-half of the transformer secondary through the lamp tube back to the neutral point, and during the other alternation by the other half of the transformer secondary through the tube to the same point, and that the choke-coil in the negative lags the current over the zero points.

On 25 cycles, by providing a larger choke coil in the negative than is necessary in the 60-cycle lamp, the natural tendency to a flicker with the period of the 25 cycles is eliminated.

The light from the alternating-current lamp is practically equivalent to that from the direct current, since in the light giving portion of the tube the current is unidirectional and practically constant.

The mercury-vapor apparatus may be utilized to supply direct current from an alternating-current source, by virtue of the negative electrode resistance. No further description of the general method of accomplishing this result is necessary at this time. The converter may be run single phase, in which case a connection similar to that already described in Fig. 2, except for starting circuits, is generally used, though it may be

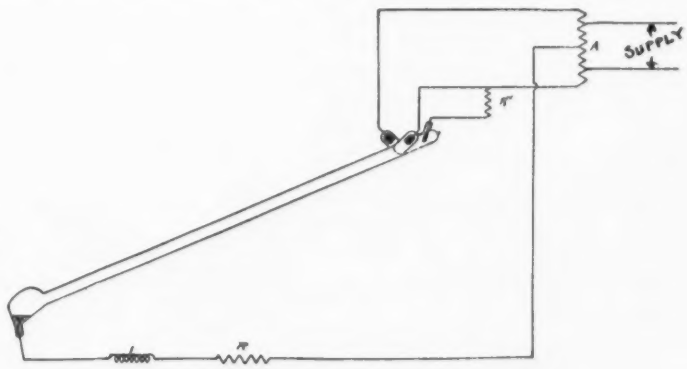


FIG. 2.—ALTERNATING-CURRENT LAMP.

three-phase, four-phase, etc., in which case no choke coil in the direct-current circuit is usually required.

In a converter a very short vapor path is purposely provided, and the starting is easily accomplished by breaking a metal circuit in the vapor path, for the current is here easily transferred from the starting to the main positive electrode. The method can be easily seen from Fig. 3, which shows a form of commercial bulb used for a single-phase converter together with starting circuits. There are two electrodes of mercury, one being the main negative and the other a starting electrode. By shaking these two together, passing current through and sep-

arating them, the negative electrode resistance is broken down and the voltage upon the main positive electrodes forces current to flow to the main negative. The supplementary positive should then be cut out of the circuit. Converters can also be started by a starting-band and a high-tension impulse, or by the direct application of sufficiently high potential.

The author stated that the ratio of the converter is a rather uncertain term, but it may be determined in any given arc as follows: Any single-phase vapor converter operated from a three-wire source, or a transformer with a middle point, is practically equivalent, as far as the direct-current circuit is concerned, to the application of the original alternating-current to the direct-current circuit (including the sustaining coil) with the negative supply alternations reversed. This gives a pulsating voltage, the pulsations being of sine form and running to zero for one instant twice every cycle. The choke-coil smooths out the current pulsations more or less according to its power and the character of the direct-current load. The smoothing action is much greater with a load of ohmic resistance than with a storage-battery or motor or other consuming device

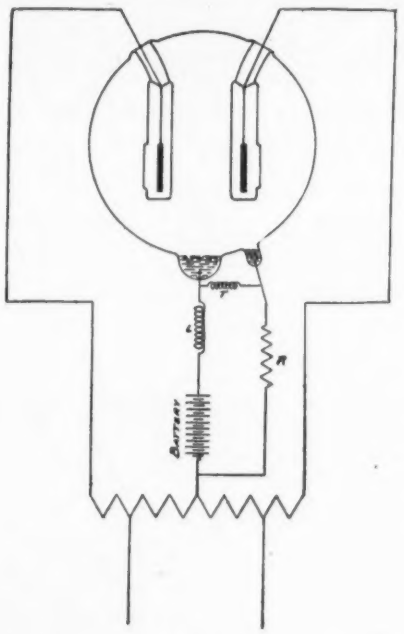


FIG. 3.—SINGLE-PHASE CONVERTER.

having a constant potential feature. The direct voltage is measured ordinarily by a voltmeter which gives the average reading, not the effective reading, of the pulsating voltage, while the alternating voltage is measured by a voltmeter which measures effective values; so that the direct-current instrument will show a reading on the same voltage of approximately 9/10 that of the alternating-current instrument. This difference appears in the ratio of the vapor converter.

Since only one-half of the voltage across the positives is operative at any one time, we have in addition the factor ½ between the voltage across the positives and that in the direct-current supply, so that the voltage on the direct-current side, measured by a direct-current voltmeter, will be 0.45 of the voltage across the positives in the condition assumed. In this case the voltage on the bulb and all auxiliary losses must be included in the direct-current load. If an alternating-current instrument be used for measuring the direct voltage a somewhat higher ratio (.50 as a maximum) may be obtained according to the degree of smoothing accomplished in the choke coil, the smoother the direct current the lower the ratio. Both alternating-current and direct-current instruments will, of course, read the same on a perfectly steady current, such as would result from an infinitely powerful sustaining coil.

A power factor meter on a vapor converter, having a resistance load, will show less than unity power factor under most conditions, and yet there is no lag between the zero point of the current and the zero electromotive force of the supply. This condition results from a distortion of the current wave resulting from the action of the sustaining coil in the direct-current circuit. The power factor appears less than unity since the distortion of the current is equivalent to the addition of higher harmonics which being of a different periodicity from the supply can deliver no real power while still increasing the effective value of the current.

Self-Excitation of Synchronous Converters.

At the Milwaukee convention of the American Institute of Electrical Engineers, Mr. W. L. Waters read a paper on the subject of shunt and compound-wound synchronous converters for railway work. By the use of a sufficient inductive reactance in the supply leads and a series winding on the magnets of the converter the terminal voltage of the machine will rise as the load comes on, so that a synchronous converter may be compounded in a manner similar to that employed with direct-current generators.

This system, which gives automatic control of the voltage, is obviously extremely useful and convenient. Unfortunately, however, the system presents a number of disadvantages in practice: a series winding is needed on the converter magnets, artificial reactance coils are practically always needed to insert in the alternating-current line so as to bring its reactance up to the required value, and there is need for extra switchboard arrangements. This means increased complication and cost and a loss of efficiency. A compound-wound converter costs about 7 or 8 per cent more than a shunt-wound converter. Reactance coils usually cost about 5 per cent as much as the converter. The efficiency of the system is lowered probably 1 to 2 per cent. Moreover, the system is more complicated, and in consequence more liable to break down. There is also liable to be trouble in operating the system. A series field winding on a synchronous converter is always a source of danger on account of the liability of its reversing. When starting a converter the series field coils can be short-circuited and the danger at that time avoided; but if the attendant forgets the short-circuiting switch at any time, there is liable to be trouble.

The results from the overcompounding of synchronous converters are not always satisfactory, due to the fact that as solid steel field magnets are always used, the magnetism cannot change quickly, and there is often a considerable time lag before the voltage changes to correspond with the change in the load. However, when the converter is flat-compounded instead of under or overcompounded, the result is more satisfactory, as the natural tendency of the solid poles is to hold the magnetism and the voltage constant.

In small sub-stations which are supplied from comparatively small power stations, the effect of the variation in speed of the engines often masks all of the results of the compound winding. Moreover, this method of compounding is often a nuisance. The power factor of the system very often varies widely with the load. A shunt-wound converter, however, tends to keep the power factor the same at all loads. In any case the power factor can be adjusted by means of the field rheostat without in any way upsetting the regulation.

The result of all the complication and disadvantages of a compound-wound converter with reactance coils is that often after the system has been in operation for some time the series magnet coils and the reactance coils are cut out and the converter is run as a straight shunt machine.

Probably the best system for general work is to have shunt-wound converters, standard transformers and no reactance coils. The converters should be overexcited somewhat so as to keep the introduced wattless currents leading at all times, and then the machines should be left to take care of themselves, the excitation being adjusted in case they fail to divide the load properly.

With shunt-wound converters instead of compound-wound machines with reactance-coils, there results an outfit less liable to cause trouble and which will give better results both in large and in small stations. The time seems not far distant when the compound-wound converter will be considered as a special type of machine.

Measurement of Temperature by Electrical Means.

In a paper presented at the Milwaukee convention of the American Institute of Electrical Engineers, Mr. Edwin F. Northrup gave an interesting discussion of electrical resistance thermometry, outlining the construction and operation of resistance thermometers, and described a new instrument, termed a "ratiometer," which reads temperatures as readily as a voltmeter reads volts.

Fig. 1 gives the diagram of connections of the instrument, and Fig. 2 illustrates details of the deflecting system and the shape of each of the two pole pieces. C_1 and C_2 (Fig. 1) are two flat coils mounted on the movable system, *a*, *b*, *c* (Fig. 2), having a damping frame of aluminum.

The two coils have *like* polarity on the same side. The system rotates between two iron crescent-shaped pole pieces of opposite

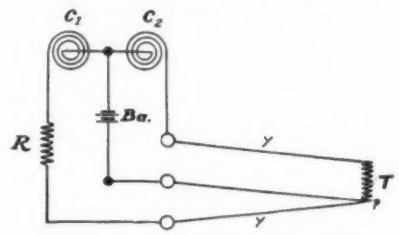


FIG. 1.—DIAGRAM OF RADIOMETER.

polarity (Fig. 2) *p*. The axis of rotation of the system approximately coincides with the center of the outside circle of the crescent. Hence, when the system rotates, one coil moves so as to get more under the pole faces, and the other coil more from under the pole faces. Now, if currents flow through both coils, and in such a direction as to cause both coils to try to move from under the pole faces, the system will seek a position of equilibrium which is independent of the actual value of the currents flowing and which depends only upon the ratio of the portions of the main current, which divides to flow in the two coils. This is true, provided only that the system is under no spring control. The leading-in wires, three in number, are, in fact, made of such delicate strips of silver that they exercise a negligibly small control as compared with the control of the magnetic forces. If, now, the ratio of the currents in the two coils is altered, the system seeks a new position of equilibrium again, independent of the value of the battery current.

Referring to the diagram of connections (Fig. 1), *R* being a

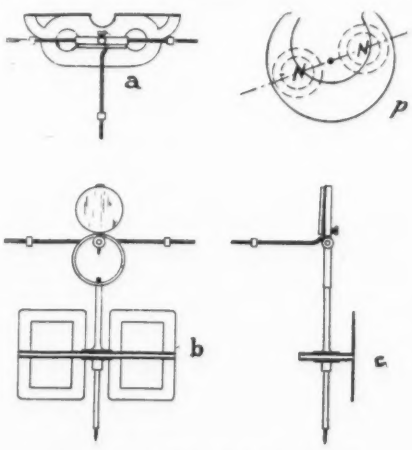


FIG. 2.—SYSTEM OF RADIOMETER.

fixed resistance and *T* a resistance which varies with the temperature, the extent of the deflection of the moving system, as indicated on a scale reflected by a mirror attached to the moving system, determines the ratio *T*/*R* whatever be the value of the battery current. The source of current may be three or four dry cells connected in series, or a commutated current may be obtained from a hand-driven magneto.

To read any temperature it is only necessary to place the thermometer, joined by a lamp cord to the instrument, in the place where the temperature is required, and look into the telescope. The scale appears to move under the cross-hair of the eye-piece to the temperature reading.

The ratiometer may be made sensitive to temperature changes of about 0.1° C., or less, and can be relied upon to be as accurate as the scale is originally calibrated, with the exception of possible fluctuations of 1°, or at the most 2°.

Comparison of Two-Phase and Three-Phase Motors.

An interesting contribution relating to the relative merits of two-phase and three-phase motors was given by Mr. Bradley McCormick in a paper read at the annual convention of the American Institute of Electrical Engineers. The author propounded the following problems: Given two similar frames without windings, how shall the two-phase and the three-phase windings differ in order to secure proper operation? What will be the comparitive losses, if the two machines are given the same rating, or if not rated the same, how shall their ratings differ? He discussed the leakage factor, the current density in the rotor and the stator, the flux variation factor which shows how nearly the field conforms to the perfect sinusoidal revolving field, and the distribution factor, which takes into account the effect on the voltage of distributing the windings into a number of slots.

The following are the principal points brought out in the paper. They are intended to aid the designer in deciding upon the proper ratings for machines when wound for two-phase or three-phase service:

1. A two-phase machine should have 22 per cent more conductors per slot than the corresponding three-phase Y-connected machine designed for the same voltage and flux per pole.

2. The magnetizing current is the same in both two and three-phase machines, when expressed in per cent, of the current which corresponds to the full load output.

3. The copper loss of the two-phase machine is 12 per cent higher than that of the three-phase.

4. The leakage factor of the two-phase machine averages 25 per cent greater than that of the three-phase machine.

Even machines of the same phase and rating which are made as nearly alike in every respect as is commercially possible, vary widely among themselves in their characteristics when put in test. This fact makes it very difficult to determine by test the relative behavior of two and three-phase machines, especially with regard to those characteristics which differ only slightly. There can be no doubt as to the higher temperature rise of the copper in the two-phase motor, occasioned by the higher copper loss. For the same reason the efficiency of the two-phase motor is slightly lower, the difference depending upon the relative magnitude of the iron and copper losses. Since the slip is equal to the ratio of the secondary copper loss to the total power input to the secondary, it is evident that the slip is greater in the two-phase motor. Calculations and tests indicate that the slip in two-phase motors is about 20 per cent greater than in three-phase motors. Due to the increased leakage, the power factor in the two-phase machine is from 1 to 3 per cent lower than in the three-phase motor.

Interurban Test Car.

Prof. T. M. Gardner presented at the recent annual convention of the American Institute of Electrical Engineers a paper containing a description of an interurban test car at the University of Illinois. The car is of the double-truck type equipped with four 40-hp, 500-volt motors, and weighs complete 27.5 tons. The testing apparatus installed in the car include a watt-hour meter for reading the energy supplied to the lighting circuits and to the air-compressor motor and also one for reading the total energy supplied to the car. Recording ammeters and voltmeters serve to measure the current and the voltage used at the car. The speed is determined by a magneto generator in circuit with which is connected an ammeter and the primary coil of a trans-

former. The current varies directly with the speed and its rate of change corresponds to the acceleration. A voltmeter connected to the secondary circuit of the transformer is arranged to read the acceleration directly in miles per hour.

Experience in an Electrically Driven Printing Plant.

In the *Electrical World and Engineer* of June 3, 1905, there appeared an article describing the electrically driven printing plant of F. S. Blanchard & Co., Worcester, Mass. This installation has now been in operation practically a year, and it is interesting to note that the production of the plant has been increased some 20 to 25 per cent by the use of the direct electric drive, in comparison with the possibilities of the old belt and shafting drive. The conditions of working are much more favorable on the score of cleanliness, convenience in operation and compactness than were found in the company's old plant.

The present equipment of the plant covers two job presses, each driven by a ¼-hp motor; an art jobber driven by a ½-hp motor, and a universal press run by a ⅔-hp motor; a four-roller press operated by a 3-hp motor, and another of slightly different make run by a 4-hp motor; two four-roller rear-delivery presses run by a 3-hp motor in each case; a press run by a 1-hp motor, a 3-hp paper cutter outfit and two linotype machines, each driven by a ¼-hp motor. All the motors but one are of the Sprague Electric Company's make, the exception being a Peerless machine.

The proprietors of the plant state that electricity has been generally satisfactory; the operating cost has not been lowered in comparison with the old power bills, but the output has been increased. The employers like the motor drive in contrast with the old equipment. The company has not advertised its use of electricity as an auxiliary to the securing of better work, preferring to let its product speak for itself. When the plant was started, it was lighted by mantle gas burners, but the advantages of electric illumination soon became apparent and the gas lamps were displaced by a modern layout of incandescents. Power is still supplied by 500-volt, direct current from the Worcester Electric Light Company, whose generating station is about a mile away.

A few minor troubles have developed since the plant started, but these have been eradicated. Some of the motor field coils had to be replaced, and the fuses gave more or less trouble by frequent blowing. The potential sometimes approached rather close to 600 volts, and before the employes became thoroughly accustomed to the service several slight shocks were experienced.

It is no small problem to design very small motors to operate with perfect success at 600 volts, but the indications are that the equipment has now been brought to the point where thorough satisfaction can be expected. At no time were the interruptions to service of a serious nature, but within the last few months the smoothness of the service has been much improved. The printing company states that if the installation were to be established again, substantially the present equipment and arrangement would be selected.

Recent Electrochemical Developments.

ELECTROLYTIC PRODUCTION OF CAUSTIC SODA AND CHLORINE.

Among the numerous designs of diaphragm cells for electrolysis of sodium chloride for the production of caustic soda and chlorine the McDonald cell has found repeatedly applications in practice, for instance in a paper mill in Pennsylvania and in chlorination works in Colorado. A patent recently granted to F. McDonald, while referring in general to the arrangement of the plant, shows quite clearly the fundamental point which is to be met in the design of diaphragm cells. It is of fundamental importance to keep the chlorine evolved at the anode, separate from the caustic formed at the cathode. The diaphragm serves for preventing the two solutions from mixing mechanically, but it cannot prevent hydroxyl ions (the number of which increases in the catholyte with the increasing strength of the caustic solution during operation) from participating in the electrolytic conduction and traveling over to the anode side of the cell. Hence it is necessary to prevent this in some other way.

The method generally applied is to feed the fresh sodium chloride solution into the anode compartment and produce a mechanical flow towards the cathode, so as to counteract the traveling of the OH ions in the opposite direction. McDonald uses an automatic device for keeping the level of the electrolyte in the anode compartment at the desired height; for this purpose he controls the supply of NaCl from the reservoir to the anode compartment of the electrolyzer by means of a valve operated by a float the position of which depends on the level of the anolyte solution.

AMMONIA.

In the endeavor to solve the fertilizer problem, which is of such eminent commercial importance, attempts to produce ammonia synthetically from its elemental constituents are apparently not without promise. The fact that this synthesis should evolve a considerable amount of heat points in this direction. But the fact that no success has so far been achieved in this line is a suggestive illustration of the limitations of the application of thermochemical data. According to the old rule of Berthelot, a chemical reaction goes on if it evolves heat, or in other words if the energy evolved by the reaction (generally measured in calories) is positive. We know now that this rule is not strictly correct; a consequent application of the two principles of thermodynamics shows that the criterion of a reaction going on in a certain direction is not that the total energy of reaction is positive, but that the decrease of "free energy" (according to Helmholtz) is positive. However, we also know, that in general at ordinary temperatures the free energy is not very different from the total energy (while at high temperatures they may be quite different). This is the reason why Berthelot's rule may be used in practice without making great mistakes, and it will undoubtedly be used for some time to come, especially as we have infinitely more numerical data on the total energy of reactions than on their free energy.

However, from thermochemical data we cannot say what will be the speed of the reaction, and this is often of the greatest importance, as in the case of the synthesis of ammonia. Here the reaction velocity is practically zero under ordinary circumstances. We must make this restriction, "under ordinary circumstances," since it is an experimental fact that we often can change the speed of a reaction by bringing the reacting substances in contact with an apparently inert substance (called a catalyzer). The catalyzer itself does not change during the reaction, but changes enormously the speed of the reaction between the other substances with which it is in contact. The most famous industrial application of this principle are the contact processes for making sulphuric acid, which have brought about almost a revolution in this industry. Now with respect to the synthesis of ammonia, various experimenters have worked in this line, but so far without success. From a thorough recent investigation of Prof. Haber it appears that even with the best catalyzer known —iron—the reaction producing ammonia is so slow as to make the process practically impossible. But this does not mean that the problem cannot be solved. The chief difficulty is that we know practically nothing concerning the rationale underlying catalytic action. We undoubtedly classify under this name various effects which may be very different in character.

While not directly in this line, a recent patent of J. A. Lyons and E. C. Broadwell for the electrolytic production of ammonia may be mentioned here. The fused borate of sodium, potassium or any other positive metal is electrolyzed in a crucible forming the cathode, while the anode is a carbon rod in the center. On account of the much smaller active surface of the carbon rod, the anodic current density is high and an intense heat is produced there. Metallic sodium, potassium, etc., is set free at the cathode, while at the anode (under the reducing action of the carbon) boron is obtained. A tube around the carbon anode serves as

diaphragm and prevents the boron from passing over to the cathode. At the same time nitrogen is introduced through this tube and combines with the boron to form boron nitride. This is brought in contact with steam, forming boric anhydride and ammonia.

ELECTROPLATING.

A recent patent of C. G. Backus and G. L. Wallave refers to details of mechanical construction of a rotatable receptacle for plating a large number of small articles at the same time.

A patent recently granted to J. W. Aylsworth, refers to a modification of his apparatus for plating long perforated strips of steel with nickel, for use in the Edison alkaline storage battery.

LETTER TO THE EDITORS.

Induction Motor Circular Locus.

To the Editors of Electrical World:

SIRS:—I have read with interest Dr. A. S. McAllister's article, entitled, "Simple Circular Current Locus of the Induction Motor," which you published in your issue of May 26. As it is just about eleven years ago that I developed and published a circle diagram for the induction motor and transformer, and as this diagram has since been my guide in designing several hundred thousand horsepower of induction motors, I have been particularly pleased with the thoughtful article of Dr. McAllister's in which he gives a method of arriving, in a very lucid manner, at the diagram of the general alternating-current transformer. It is interesting to look back to the day when the phenomena in induction motors were still very hazy, even in the minds of those who were then the best experts in the field, and to ponder upon the fact that how little, after all, our knowledge on the subject has been advanced since that day. The mark of progress shows itself invariably in simplification and we, therefore, must congratulate Dr. McAllister on the simple and logical manner in which he has succeeded in developing and building up the circle diagram of the induction motor and transformer.

CINCINNATI, OHIO. B. A. BEHREND.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Mechanical Design of Commutators.—LIVINGSTONE.—The first part of an article on the mechanical design of commutators for direct-current generators. They should have an ample wearing depth of copper. If every commutator is designed to last the same length of time and the amount of wear on a bar due to sparking and friction every time it passes under a brush is a constant, then the wearing depth should equal $c N n$, where N is revolutions per minute, n the number of brush spindles, and c a constant depending upon the desired life of the commutator. For ordinary generators a value of c equal to 0.005 to 0.0055 may be taken when getting out a design for a new machine. In order to design the commutator so that when worn down to the limit the stresses in the materials will not be unduly increased, the type of construction shown in Fig. 1 is, according to the author, the

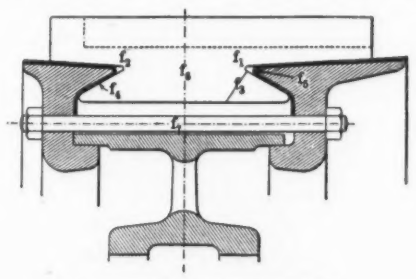


FIG. 1.—COMMUTATOR DESIGN.

best one. The commutator should, further, be assembled so rigidly that a blow on the surface with a light hammer will not displace any bar. The only way to provide for this is to design the commutator so that a tension in the bolts of 12,000 lb. per square inch will give a pressure on the mica, between bars, of 25 D lb. per square inch when D = the diameter of the commutator in inches. Mica of such a quality should be used that the copper and the mica will wear uniformly. Experience shows that for this purpose soft mica about 0.03 or 1/32 in. thick between bars of hard-drawn copper is best. It is important that the strains due to initial tension and expansion due to heating and centrifugal force shall be well within the elastic limits of the materials so that there will be no permanent set and consequent loosening of the bars on cooling down. The author gives the mathematical expressions for the stress at different points. The paper is to be continued.—Lond. *Elec.*, May 18.

Design of Generators.—HORSNAILL.—A mathematical paper on the use of comparative empirical formulas in the mechanical design of electrical generators. He first considers the diameter of the shaft required to carry the revolving parts without undue flexure or vibration. The size of the shaft is discussed from the point of view of stiffness only. The second problem dealt with is the size of bearings and the third problem, the stiffness of alternator armature frames and dynamo magnet yokes. Formulas are given and illustrated by numerical examples from actual practice.—Lond. *Eng'ing*, May 11.

Single-Phase Motor.—OSSANNA.—A communication giving a formula which shows the influence of the transformation ratio of the exciting transformer of the Winter-Eichberg motor upon the speed at which full compensation is obtained.—*Elek. Zeit.*, May 17.

Repulsion Motor.—An abstract of an English patent of the Union Electricity Company, of Berlin, for an improved compensated repulsion motor.—Lond. *Elec.*, May 11.

Polyphase Induction Motor Winding.—CHAPMAN.—A mathematical article indicating a rapid method of determining approximately the most suitable winding from the point of view of power factor and overload capacity, for a motor whose mechanical dimensions are already fixed.—Lond. *Elec.*, May 18.

Direction of E.m.f.—ORILE.—A brief note with a diagram on an easy method of determining the direction of e.m.f. in generators and the direction of rotation of motors.—*Elek. und Masch.*, May 13.

Lamps and Lighting.

Long-Flame Arcs.—ANDREWS.—The conclusion of his paper on long-flame arc lamps in general and the Carbone lamp in particular. After some data on the general effect and distribution of light he speaks on alternating-current arcs which are said to be very unpopular in England on account of their low useful efficiency. This is due in a great measure to the fact that about 50 per cent of the light is thrown up into the air, where for many purposes it is entirely wasted. This defect, however, disappears in long-flame, downward-feeding carbon arcs as the light emitted by both craters is thrown down so that the efficiency of the alternating-current and the direct-current arc is about the same. The author then gives some observations showing that a downward-feeding carbon lamp on a 50-period circuit gives the same effect as an ordinary lamp on a 100-period circuit, so that the use of downward-feeding carbon arcs obviates to some extent the disadvantage of flickering. In the discussion which followed some statements of Patchell from his experiences are interesting. He referred to the new system of lighting of the Charing Cross station in London, where competitive tests were made between gas and electric light. The electric light company had 8 Sale-Onslow, high-pressure gas lamps to compete with and put up 5 Oriflamme arc lamps and price for price "they beat the gas company hollow." On the basis of price for price the electric arcs gave 45,000 cp

as against 25,000 cp for the gas lamps. He had made extended tests of various arc lamps and especially flaming arc lamps and gave the following figures in which the cost per 1,000 cp-hour is given at the rate of 4 cents per kw-hour.

Type.	Watts.	Cost per 1,000 cp-hr.
Oriflame	350	0.8 cents
Weinert	350	1.10
Excello	470	1.14
Santoni	420	1.4
Carbone lamp	1,000	2.0 (excluding trimming and carbons.)
Open arc	500	3.0
Enclosed arc	500	4.0
Enclosed midget arc	250	6.0

"He had been much struck when in the United States last year that there were practically no flame arc lamps, and he attributed that to two causes. One was that the lighting was almost entirely in the hands of the big companies, and the enclosed lamp was favored, due to the lesser labor, for this lamp would burn longer hours, and the companies seemed to appreciate that better, because one man could trim 600 lamps, whereas in England 40 lamps was considered ample for one man. This applied both to street lighting and store lighting. Another reason for their not having the flame lamp in the United States was—and this had been confirmed by the engineer of one of the largest American undertakings—that they simply did not know what high-pressure gas was." He considered that the chief disadvantage of the present flame-arc lamps is that they do not burn long enough hours, and he thought that the magazine arc lamp was the lamp that the manufacturers of flame arcs would have to put their money into. He had not, so far, found the gas and fumes from flame lamps cause any deleterious effects. The maintenance he had found, after running a good many, was a mere bagatelle. Answering some questions he replied that the above figures do not include carbons and are for mean spherical candle-power.—Lond. *Elec.*, May 11 and 18.

Standardization of Arc Lamps.—Two committees appointed by the Assoc. of German Elec. Eng. and by the Assoc. of German Central Stations make the following proposals with regard to the rating of arc lamps. An arc lamp is to be rated for practical purposes according to its most important field of application, namely, the direct illumination of the space below a horizontal plane laid through the radiating point. It is to be rated, therefore, by the mean lower hemispherical candle-power designated by $J\upsilon$ and measured in hefner candles (indicated by $HK\upsilon$). The measurement is to be made with the arc lamp in the position as used in practice but without external reflector and with clear glass globes of the same dimensions substituted for the globes used in practice. With alternating-current arc lamps the test is to be made with sinusoidal e.m.f's and a frequency of 50 periods. "Practical power consumption" of an arc lamp is the total power consumption of an arc lamp circuit (measured at the points where this circuit is connected with the network) divided by the number of lamps. By stating this practical power consumption, the voltage of the network is also to be stated. "The practical specific power consumption" is the practical power consumption just defined divided by the mean hemispherical candle-power and is designated by "$W/HK\upsilon$ at n volts in the network" (watts per hemispheric hefner candles, etc.). With alternating-current arc lamps it must be stated in every case whether non-inductive or inductive series resistances are assumed. The value "$HK\upsilon/W$ at n volts in the network" is called "practical light output" (Lichtausbente). Rules are also given on photometric tests of arc lamps. The above rules are explained and defended in a long memorandum. It is stated that in the committees it had been repeatedly suggested to state not simply the hemispherical candle-power, but also the mean spherical candle-power. However, this suggestion was not adopted because it was thought it would introduce confusion.—*Elek. Zeit.*, May 17.

Spherical Photometer.—Corsepius.—An illustrated description of a new form of construction of the spherical photometer of Ulbricht. It is shown in Fig. 2. The internal diameter is 2 meters. The sphere is made of gypsum. The whole sphere is divided vertically into two halves of which one is stationary, while the other is set on rollers and may be moved. In the stationary half a metallic ring is placed at the top, which in the construction of the author has a diameter of 20 cm. and a height of 11 cm., so that it suspends somewhat into the interior of the sphere, the thickness of the walls of the sphere being 4.6 cm. The window, *M*, at the right, has a diameter of 20 cm. The opening of the screen, *S*, placed in the zero point of the photometer, is normally 16 cm., but may be diminished at will. The screen, *B*, is placed so that not only the window, *M*, itself, but also a border around it is shadowed. The distance of the lamp, *L*, from the

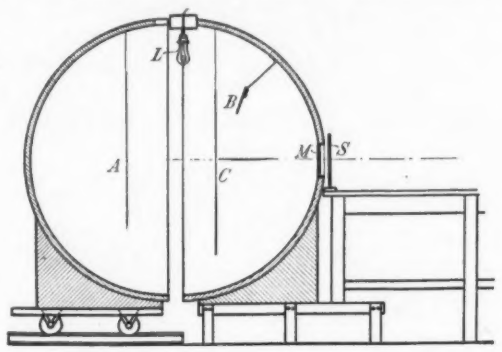


FIG. 2.—DIAGRAM OF SPHERICAL PHOTOMETER.

upper wall of the sphere is 28.5 cm., the distance from the center of the screen 34 cm. The screen is placed in an inclined position and is of oval form. The calibration of the photometer is made with two incandescent lamps, the mean spherical candle-power of which has been determined by the Reichsanstalt. The author urges that arc lamps should be rated according to their mean spherical candle-power. He describes a simple method of determining the distribution of light with the aid of photographic papers placed at different points. Some results of tests of various lamps are given and it is pointed out that the new metallic filament lamps are more efficient than alternating-current arc lamps. —*Elek. Zeit.*, May 17.

Tungsten Filament Lamp.—Kuzel.—A brief communication, in which the writer first gives some notes on former work on tungsten lamps and mentions that Lodyguine took two patents out in 1894. The writer's own process is stated to be based on two new inventions: one is that metals in the colloidal condition form plastic masses without the addition of a binding material, and can be formed easily into colloidal wires. The second is that wires formed in this way and dried undergo a physical change when subjected to strong heat; without breaking or disintegrating into powder they pass over from the colloidal condition into the crystalline condition and the lamp filament is thereby finished. The author says he can change in this way the metals into filaments. He gives some results of tests of his lamps which have been already fully noticed in the Electrical World.—*Elek. Zeit.*, May 10.

Metal Filament Lamps.—Ballois.—A review of recent inventions in metal filament lamps. The article does not seem to contain anything new.—*L'Eclairage Elec.*, May 12.

Power.

Swiss Transmission Scheme.—A note stating that the city of Zurich will spend a sum of $2,137,000 for the installation of a generating plant in the Albula Valley, where water power of 24,000 hp is available. There will be 8 generating sets, each consisting of a turbine and generator. Two projects have been proposed, one for the generation and transmission of three-phase currents at an initial pressure of 46,000 volts and a final pressure of 70,000 volts; the other for power transmission by direct current at 79,000 volts between the two conductors with an intermediary neutral point connected to earth so that a voltage of 39,500 exists between each conductor and earth. In both cases the line must have two conductors and in the case of three-phase currents the conductors must have a cross-section of 50 sq. mm. and in the case of direct current a cross-section of 36 mm. The cost of $957,000 for the hydraulic installation and $1,180,000 for the electrical installation with the three-phase project and $1,110,000 for the direct-current project.—*L'Eclairage Elec.*, May 12.

Traction.

Single-Phase Traction.—FUMERO.—An illustrated description of the Finzi single-phase traction system installed on the Milan exhibition. The track is double throughout and has a length of about 1,500 yards. The working pressure is 2,000 volts, but a series of experiments will be made with voltages varying from 2,000 to 10,000. Fig. 3 shows the arrangement of the high and low-tension circuits on the train. The most important characteristic of the system consists in the easy control from either end, which is obtained by the division of the transformer into two parts, one of which is in the front carriage and the other in the last. The high-tension, 2,000-volt, 15-period current after first passing through the choking coil of the lightning arrester, is led into the relay of the main switch, which can be operated either manually or automatically. From the relay it passes through the switch, main fuse and thence to the primary of the transformer in the first carriage. Then it goes through one of the three wires placed on the roofs of the carriages, to the primary of the second transformer in the last carriage and finally to earth. The third high-tension line serves to put in parallel the primary of the first transformer with either of the main switches, and hence with the trolley. The end carriages are equipped each with two Finzi single-phase motors of 30 hp each, while the intermediate carriages have each a single motor. The complete equipment of a train, therefore, consists of six motors, of which a group of three is coupled up in series with the secondary of the transformer. By means of the special device of dividing the transformer in two, the first position of the controller handle applies to the terminals of the motors a pressure corresponding to the secondary of the transformer placed in the last carriage, or the half of the whole available pressure. Experience has shown that this amount is the best adapted for starting the single-phase motors in series. Passing from position 1 to 2, 3, 4, 5, 6, 7, the pressure is increased by steps of 30 volts each time, thus bringing it up from 180 to 360 volts. As there are always three motors in series on the secondary side, each obtains an initial pressure of 60 volts, which is stepped up by 10 volts successively to a final value of 120 volts. The arrangement is quite symmetrical for operating from either end of the train, and thus it is possible, by manipulating the controller, to obtain any secondary pressure that is required. To reverse the motors the action of the controller is the same as for continuous-current working. The original intention was to use two bow trolleys, one for the outward and the other for the return journey. But in view of accidents which might happen if it were forgotten to lower one bow, a new type of trolley has been designed with a double collector, to minimize sparking. The rhomboidal arrangement of the links (Fig. 4) is very elastic and insures that, when one of the rollers momentarily leaves the wire as it passes a point of support, the other is making good contact. The rollers were carefully designed to revolve easily in their bearings. The provision of two rollers has the further advantage for high-tension lines that it renders it unnecessary for the driver to break the circuit when passing section insulators. The Finzi motors have laminated poles and a compensating winding for the production of a flux at right angles to that of the field. This neutralizes the effects of the armature self-induction, increases the power factor and maintains a high efficiency. The armature is built up of stampings on a steel spider and has 65 conductors in slots. The commutator segments are each composed of a large number of thin plates connected up without resistances to the conductors. Choke coils are used in passing from one position of the controller to the next.—Lond. *Elec.*, May 11; from *L'Elettricita*, April 17.

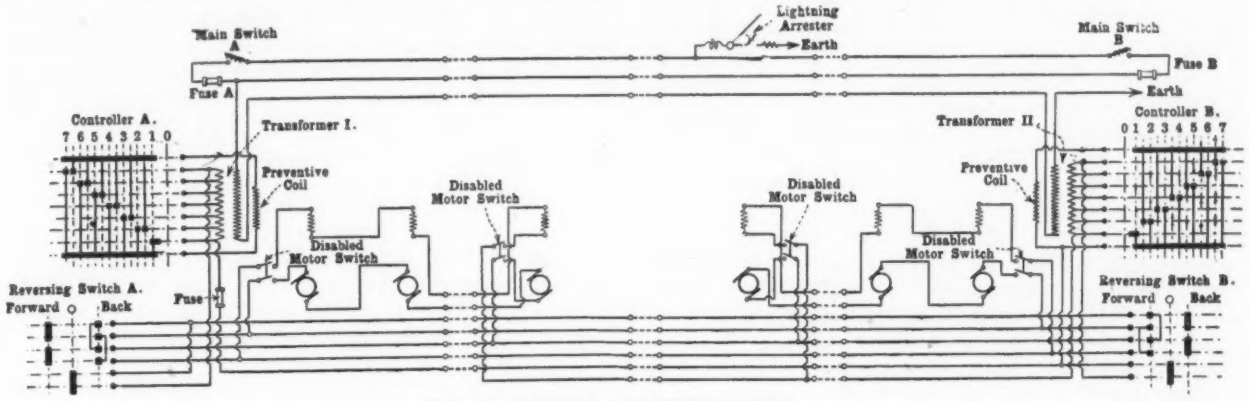


FIG. 3.—DIAGRAM OF TRAIN CIRCUITS.

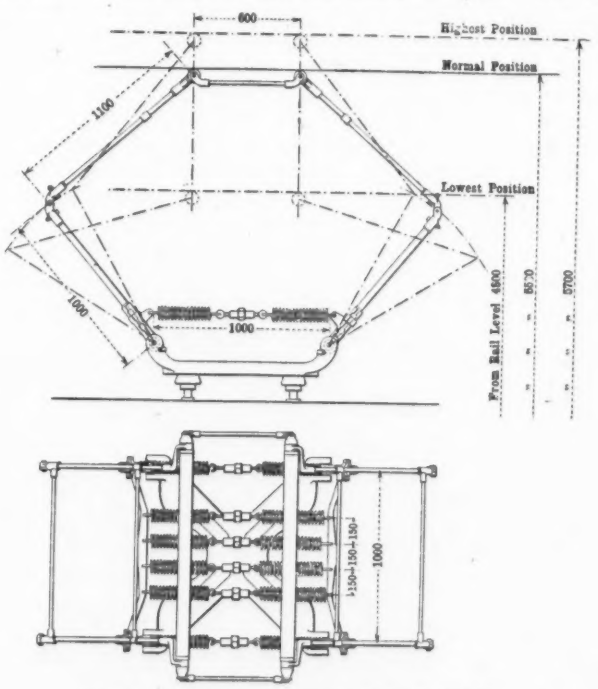


FIG. 4.—ELEVATION AND PLAN OF TROLLEY.

Regulations for Electric Traction.—Extended safety regulations proposed by the committee of the German Assoc. of Elec. Eng. for electric traction systems.—*Elek. Zeit.*, May 17.

Installations, Systems and Appliances.

Lighting Plant of a Summer Resort.—WERTENSON.—An illustrated description of the municipal lighting plant of Kissingen, which is a refined summer resort in Germany. The consumption of electricity during the winter by the residents of the town is small, while during the summer months the load is a maximum between 8 and 10 o'clock in the evening due to the consumption of electricity in the hotels, theatres, etc. Since the place has a refined character there are comparatively few motors for workshops, etc. For this reason the city hesitated a long while before erecting a plant and the contractor had to guarantee that the works would pay interest on the capital. The capital was provided by the city. The connected load is about 600 kw and a gradual increase up to 900 kw is expected. For this reason the capacity of the station was made 400 kw in the beginning, which will be increased to 600 kw later on. The three-wire, direct-current system with a storage battery giving 1,700 ampere-hours for a three-hour discharge is used. For the most part of the year a single attendant is sufficient and only during times of highest load

are two men required. In order to make the station pay, the prices charged in summer months are high compared with the prices charged in winter. The price for electricity is in summer 17.5 cents, in spring and autumn 13.75, and in winter 11.25 cents per kw-hour for the first 150 kw-hours consumed during one month; for further kw-hours consumed up to 300 the price is reduced by 1.25 cent and for further kw-hours above 300 again by 1.25 cent. The price for electricity varies, therefore, between 17.5 and 8.75 cents per kw-hour. For motor purposes the fundamental rate independent of the season is 6.25 cents per kw-hour on which a discount is allowed according to consumption, so that electricity consumed for power purposes above 2,000 kw-hours per month costs only 2.5 cents per kw-hour.—*Elek. Anz.*, May 13 and 17.

Regulating the Voltage of Lighting Batteries.—Hollis and Alexander.—The first part of an illustrated paper read before the New Castle section of the British Inst. Elec. Eng. The authors compare the following two methods of keeping the voltage of a battery constant during discharge, one by means of a booster in series with the battery and the other by additional cells and a regulating switch for cutting them in and out. Of these two methods the former seems to be generally adopted in England, but the authors do not think that this is due to any special advantage of the former method, but because the latter case has not had a sufficient and fair consideration as regards the capital costs. In the present installment they compare the batteries required in both cases. The paper is to be continued.—Lond. *Elec. Eng.*, May 18.

Resistances with Lightning Arresters.—Benischke.—A paper read before the Berlin Elec. Society and explaining in detail the function of the resistances in the earth connections of lightning arresters. For these resistances there is an upper and a lower limit. The upper limit is such that the atmospheric discharge flows off quickly to earth while the lower limit is such that the short-circuit current following is as small as possible. The author described resistances made of carborundum and their advantages over water resistances are pointed out. An account of the discussion is also given.—*Elek. Zeit.*, May 17.

Economy of Central Stations.—Some notes by an American visitor on the British electrical industries. The American has noticed in England that some of the later projects have been engineered with an eye single to commercial efficiency—as distinguished from technical efficiency—and the capital has been held down to the figure on which returns are reasonably certain. This means a general drift away from over-refinements that do not pay for themselves. On the other hand, concerning English central stations he complains that they do not yet realize that the engineering side of the station work has become of secondary importance; that the main question to-day is not how to give a constant supply, but how to build up a good solid load in the face of ever increasing competition. There is a general apathy among central station managers. "The corporation-owned properties are the worst of all, but the limited companies are bad—very bad—many of them. They seem to take such business as a kind providence sends them." Hunting for business can be done in many ways, for instance, getting merchants to light their show windows after business hours. "The first thing is to turn the mind from penny economies of operation to the pound possibilities of additional business." As to economies of operation, the English stations are excellent. They run as cheaply as the best American ones—or would run as cheaply if the management would procure them the business to run on.—Lond. *Elec. Times*, May 17.

Electrochemistry and Batteries.

Metallurgy.—Hadfield.—A lecture on unsolved problems in metallurgy. After some remarks on the variation of the magnetism of certain alloys with a change of temperature he speaks of the use of electric furnace for making iron and steel. "Where water power and suitable iron ore can be found together, then, no doubt, satisfactory electrical smelting practice will be developed, but this can only come slowly." He does not think that the old type of crucible steel smelting has been threatened with extermination by the electric furnace. He makes some remarks on alloys and their special properties and on recent rapid progress in pyrometry.—Lond. *Elec.*, May 11.

Storage Battery.—Some notes on the "X" storage battery of Oppermann, the feature of which is the mixture of the active material with very finely divided inert hair and fibre to make them more porous.—Lond. *Elec.*, May 11.

Units, Measurements and Instruments.

Measuring Small Alternating Currents.—Voege.—An illustration of a new hot-wire instrument for measuring small alternating currents with direct-current instruments. Its principal features are the small consumption of energy and its high sensitiveness. The principle is indicated in Fig. 5, in which *H H* repre-

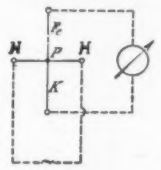


FIG. 5.—DIAGRAM SHOWING PRINCIPLE OF HOT-WIRE INSTRUMENT.

sents a platinum wire which serves as heating wire, the alternating current to be measured being passed through it. At the point *P* of this platinum wire two wires are soldered to it, one consisting of iron (Fe), the other of constantan (K). The free terminals of these two wires are connected to the direct-current instrument, the system representing a thermo-electric circuit. The wires are as thin as possible in order to get the masses to be heated as small as possible. The deviation of the needle of the galvanometer is almost independent of the direction of the current passed through *H H*, but the readings are not absolutely equal in both cases for the reason that the point *P* is not a mathematical point, but has a certain elongation. For this reason the very small drop of voltage within the point *P* of the heating wire increases the current of the thermo-electric circuit for one direction of the current and decreases it by the same amount for the other direction. To overcome this difficulty it is only necessary to calibrate the instrument by passing direct current through *H H* in opposite directions, and they take the average of the two readings. This gives the correct calibration for alternating current. The apparatus is placed in a kerosene bath and is set into a second glass vessel and is then practically independent of external variations of temperature. Fusing of the heating wire with overload is prevented by connecting it in series with an iron wire of 0.02 mm. thickness and about 2 mm. length. The sensitiveness can be still further increased by evacuating the glass vessel. It is then possible to obtain continuously 10 millivolts at the terminals of the thermo-cell with about 0.1 amp. With mirror galvanometers of suitable sensibility currents down to 1 milli-ampere may be measured. In measuring 1 milli-ampere the power consumed by the instrument itself is about 0.00005 watt.—*Elek. Zeit.*, May 17.

Alternating-Current Galvanometer.—Abraham.—A note on a French Academy paper giving a description of a moving-coil galvanometer for measuring alternating currents of the order of 0.01 micro-ampere in which the field is excited by an alternating current of the same frequency as that to be measured, by means of a small transformer. The apparatus was constructed with the collaboration of Carpentier. The general arrangement is similar to the ordinary D'Arsonval galvanometer. The alternating-field magnet induces currents in metallic parts of the instrument which tend to react on the moving-coil circuits so that if there is any dissymmetry in the construction, the moving coil is lightly deflected one way or the other. This effect can be compensated for by placing in the air-gap a small metal sheet in a correctly-adjusted position. If the magnet be excited and the moving coil short-circuited with a low resistance, it instantly takes up a position where it is not traversed by any flux. If moved from this position a powerful directing couple is produced, due to the current induced in the coil. This couple, which is due to the lag in phase of the induced current, would considerably reduce the sensitiveness of the instrument, but is avoided in actual use by including a capacity shunted by an adjustable resistance in the moving-coil

circuit. By overcompensating with too large a capacity, a couple is produced which opposes the torsion of the suspension, so that a smaller net controlling couple can be obtained than that corresponding to the suspension alone. In one instrument constructed, the moving coil had a resistance of 200 ohms and a period of swing of 10 seconds. The compensation of the electrical directing couple was affected by a 0.5 microfarad condenser shunted with 2,000 ohms. The sensitiveness with a scale at 1 meter distance was 275 mm. per micro-ampere.—Lond. *Elec.*, May 18.

Uniform Notation.—STRECKER.—A report of a committee of the German Assoc. of Elec. Eng., which has worked together with committees of the German Phys. Soc. and the Society of German Engineers as well as with other German and foreign societies to discuss a system of uniform notation. The proposals and the different opinions held by the different societies are very clearly tabulated.—*Elek. Zeit.*, May 10.

Calculating Springs.—EDLER.—The conclusion of his mathematical paper on the calculation of springs for electrical and mechanical apparatus.—*Elek. und Masch.*, May 13.

Miscellaneous.

Electric Blast Apparatus.—MAURICE.—The first part of an illustrated serial on electric blast apparatus with special reference to its use in coal mines. In the present installment he describes constructions of fuses and exploders.—Lond. *Elec.*, May 18.

BOOK REVIEWS.

WIRING HANDBOOK. By Cecil P. Poole. New York: McGraw Publishing Company. 85 pages, 61 illustrations, 32 tables. Price, $1.00.

This is an excellent treatise for wiremen and practical workers in the electric lighting and motor field. The book treats of wiring terms and measurements of feeders and mains, three-wire circuits, determining wire sizes, direct-current motor wiring, alternating-current wiring, determining the size of bus-bar conductors, switch connections, motor connections, transformer connections, watt-hour meter connections. It also contains a digest of the Underwriters' rules applying to interior wiring, fundamental formulas and 32 labor-saving tables. The latter are printed on separate sheets of tough paper and bound in the back of the book in order that they may be spread out conveniently for use and without reference to the text after the user has become familiar with them. For a book of modest dimensions the treatise is unusually complete. The absence of a table giving the diameter, area, weight, length and resistance of standard copper wire, however, is a regrettable omission.

DIE ELEKTROLYSE GESCHMOLZENER SALZE. Dritter Teil: Elektromotorische Kräfte. By Richard Lorenz. Halle: Wilhelm Knapp. 322 pages, 75 illustrations. Price, 10 marks.

This third part completes the admirable treatise which Prof. Lorenz has written upon the electrolysis of melted salts. These 790 pages are worthy of being styled a classic; in them is brought together not only all that was previously known on this subject, but almost as much again of entirely new matter, contributed outright by Prof. Lorenz. Not since Moissan's classical "Le Four Electrique" has a scientific work of this magnitude contained so much original work, therein first published. This third part treats of polarization phenomena in melted electrolytes, cells with molten electrolytes, theoretical calculations on these cells, decomposition tensions, and applications of the ionic theory. Not only are all the facts classified and tabulated, but most illuminating discussions of the theory of the phenomena are set forth. We venture to say that in future no electrochemist dare pretend to be posted on the electrolysis of molten salts until he has read and digested this monumental treatise.

STANDARD TELEPHONE WIRING. For Common Battery and Magneto Systems. By James F. Fairman. New York: McGraw Publishing Company. 91 pages, 74 illustrations. Price, $1.00.

This handbook is intended particularly for telephone wiremen, and as such its information is all of a direct practical nature. A short introductory section gives an account of electrical units and electrical circuits. Following is a section on telephone apparatus, in which well-illustrated descriptions in simple terms are given of telephone receivers and transmitters, condensers, various types of telephone bells, magnetos, lightning arresters, etc. The following sections are on installation, common battery systems, magneto systems and troubles, respectively. Plain instructions are given for connecting different types of apparatus to both the common battery and magneto systems, and all connections are clearly shown by lettered diagrams. In the section on troubles, the troubles likely to be encountered are classified, and the symptoms, causes and remedy given. The final pages of the book contain such rules of the National Electrical Code as apply to telephone installations. To all connected with the practical side of telephony this book should be of great assistance in their daily work.

PRACTICAL ELECTRIC RAILWAY HANDBOOK. By Albert B. Herrick. Second Edition, revised and corrected. New York: McGraw Publishing Company. 459 pages, 329 illustrations. Price, $3.

The second edition of this excellent electric railway manual has been thoroughly revised. A number of sections have been rewritten and expanded and new subjects introduced to accord with recent developments in electric traction. New methods of testing are also given and data added on new types of apparatus. The 450 pages of text in small print contain an immense amount of matter, almost all of a practical character, and of value to every one connected with the electric railway industry. The subjects of the nine sections in which the book is divided are as follows: General tables, testing the track, the power station, the line, the car house, the repair shop, the equipment, the operation. The section on testing is of particular value for the reason that all of the methods are of direct application of electric traction work, and many of them have been specifically devised for this sole purpose. In the section on the equipment, data of all the latest types of motors and controllers are given, including those of the General Electric & Westinghouse single-phase systems.

A PRACTICAL TREATISE ON THE STEAM ENGINE INDICATOR AND INDICATOR DIAGRAMS. Second Edition, Revised and Enlarged. By W. Worby Beaumont. New York: D. Van Nostrand Company. 250 pages, 128 illustrations. Price, $2.50 net.

This treatise, though primarily written for English engineers, is also applicable to American practice. It is written in a plain and comprehensive style which makes the instruction interesting, holding the reader's attention closely from cover to cover. It gives examples of the application of the indicator to simple, compound, triple and quadruple-expansion stationary steam engines, dealing with pressures up to 350 lb. per square inch, thus bringing the work up to date. The indicating of both simple and compound locomotives is given due attention, with numerous diagrams from them, taken under various conditions.

A chapter on the indicating of gas and oil engines contains diagrams taken from engines of these kinds developing as low as 8 and as high as 875 hp, using pressures ranging from 25 to 500 lb. per square inch. These diagrams are fully explained, and as the internal combustion engine is rapidly assuming a commanding position among the world's prime-movers, every engineer who would be considered an expert along this line should understand the principles involved in indicating such engines and making the necessary calculations. Careful study of this work will supply much of the required information. Only simple mathematics are used, and these are presented in acceptable form to those engineers who are not college graduates.

AMERICAN TELEPHONE PRACTICE. By Kempster B. Miller. Fourth Edition, enlarged and entirely rewritten. New York: McGraw Publishing Company. 888 pages, 643 illustrations. Price, $4.00.

This standard work is so well known that it is unnecessary to give, in a notice of a fourth edition, a general review of its contents. The present edition has been very largely rewritten, obsolete methods and equipment have been eliminated and much of the historical matter in former editions cut out, in order to

make room for an account of modern methods and apparatus. The classification has been considerably altered, some of the old chapters having been combined with others in order to effect a more logical arrangement. A chapter treating generally of the telephone exchange has been added as an introduction to subsequent chapters which deal with the various parts of the exchange, particularly the switchboard system, appliances and auxiliaries. The common battery, or central energy system, is, in this edition, treated exhaustively, and a complete description is given of the modern Strowger automatic telephone system. The present edition contains 42 chapters, of which 20 are almost entirely new. Subjects such as trunking between common battery offices, private branch exchange service, measured service, toll switchboard systems and power plants, are also treated at length in this edition for the first time. The author has performed a service of high value to the telephone public in undertaking from time to time the enormous labor which in such a rapidly growing art must be necessary to keep a book of this exhaustive character up to date.

BOOKS RECEIVED.

Telegraphie und Telephonie. Elementare Vorlesungen. By Dr. Richard Heilbrun. In nine parts. Berlin: Georg Siemens. Price, complete, 15 marks.

Trattato di Telefonia. By I. Brunelli and E. Longo. In twelve parts. Rome: G. Scotti & Company. Price, each part, 1.25 lire.

Lexikon der Elektrizitat u. Elektrotechnik. By Fritz Hoppe. Issued in 20 parts. Wien: A. Hartleben. Price, complete, 10 marks.

Backstrom-Smith Steam Turbine.

The first Backstrom-Smith turbine was recently successfully tested in the Oneida Street plant of the Milwaukee Electric Railway & Light Co. The interest of this turbine lies in the fact that it operates under constant stage-pressures to suit varying loads from the maximum down to the minimum, and that it is instantly available for either condensing or non-condensing work, the output of the machine remaining unchanged. Another feature of the machine is the simplicity of its mechanism and the methods of its construction which enable it to compete with other forms of prime-movers in economy, first cost and maintenance expense.

In general, the Backstrom-Smith steam turbine may be described as a multi-cellular turbine of the inflow type. Its general form is shown in Fig. 1. Special means are provided for direct coupling to alternator and exciter. It is claimed that this turbine is the first to be provided with means for meeting the requirements of changing loads without throttling, thereby making it nearly as economical for light loads as for the heaviest. The mechanism by which this is accomplished is as follows:

Flexible steel bands are secured to the periphery of the nozzle sections and to spools or rollers (Fig. 2) mounted on a collar or ring which has a limited rotary travel around the housing, inside of which each turbine wheel revolves. A movement of this collar winds or unwinds the steel tape on each of the spools, uncovering or covering the series of nozzles or ports which admit steam to the active buckets of the turbine wheels. This winding or unwinding is done automatically, the device being so arranged that the flow of steam is always in proportion to the load, steam entering the different stages at a predetermined and constant pressure, but in varying quantities, depending upon the number of nozzles uncovered by the steel tapes. This automatic regulation is accomplished by means of a shaft running the full length of the turbine in the bottom of the housings. At proper intervals on this shaft are keyed pinions which engage corresponding teeth cut in the ring or collar on which the several tape rollers are mounted, these rollers engaging with short racks secured to the nozzle ring or housing. The minutest motion of the shaft results in winding or unwinding the tape on the rollers, thus closing or opening more or less of the nozzles. The motions of the shaft operating this ingenious cut-off mechanism are controlled by the governor shown at the left in Figs. 1 and 3. The governor controls a flow of oil under constant pressure, which by means of a pressure cylinder and a rack and pinion, rotates the shaft in one or the other direction. The governor is dependent upon the proper action of the lubricating mechanism, as any accident to the latter results in an automatic stopping of the turbine, thus insuring the machine against self-destruction.

In addition to this governor with its two important functions, a safety device is provided in the shape of a safety governor controlling a butterfly valve, which closes automatically when the turbine speed reaches 5 per cent above the normal and is otherwise inoperative.

In the size illustrated (400 kw) recently tested in the Oneida Street plant of the Milwaukee Electric Railway Company, there are ten turbine wheels or runners, the general form of which is shown in Fig. 4. This illustrates a runner in one of the earlier stages, the bucket face of each successive wheel being wider. All the runners have an equal number of buckets of a uniform cross-section. This feature applies as well to the nozzles.

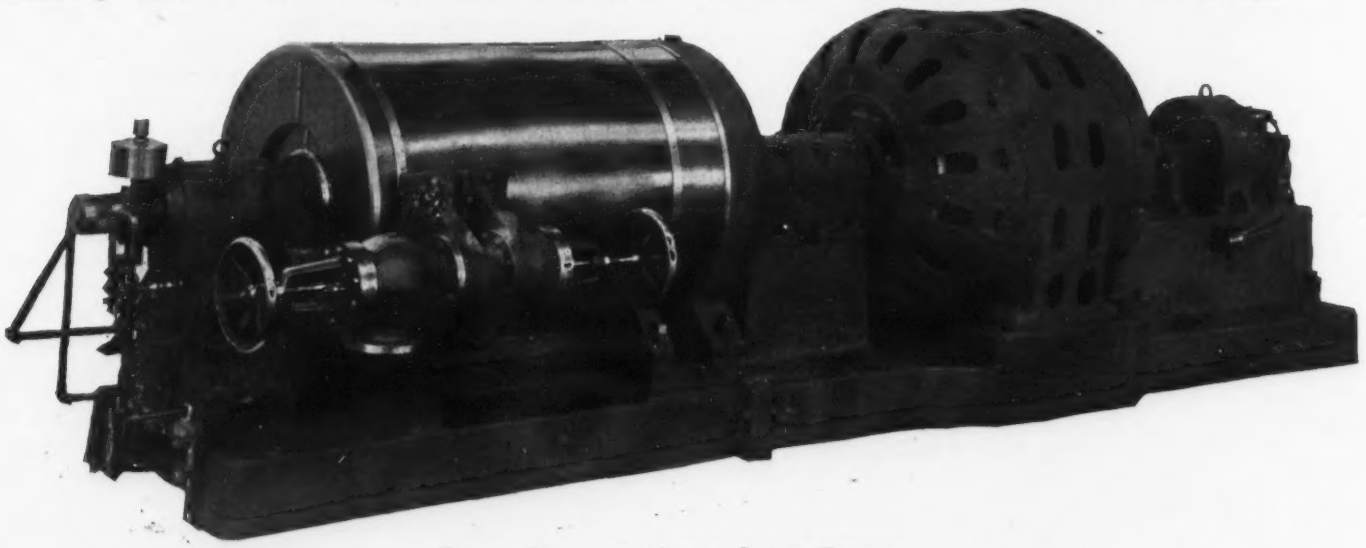


Fig. 1.—Backstrom-Smith Steam Turbine.

It is the claim of the inventor, Mr. C. A. Backstrom, that superheated steam is not as essential to the economical operation of this type of turbine as is the case in others for the reason that there is a minimum of condensation, because of the constant pressure and temperature maintained at all loads in all the stages of the turbine; that all the water contained in the steam is separated and shifted or drained into the succeeding stage by automatic means, where it is at once in part, if not wholly, re-evaporated, thus becoming useful energy; and that, by using high steam velocities, the surplus velocity appears in the form of superheat, which greatly reduces internal condensation and skin friction. As an illustration, steam at 150

lbs. gauge pressure reaches the first stage of the turbine at a temperature of 366° F. Any water contained in this steam is separated from it, falling to the bottom of the stage-chamber, from which it passes through an automatic device into the

FIG. 2.—FLEXIBLE BAND ON ROLLER.

second stage, where the pressure is, say 91 lbs. and the temperature 332° F. An instantaneous evaporation naturally follows from these differences in pressures and temperatures.

The turbine as built and installed for use in connection with a condenser, is arranged so that it may be quickly converted

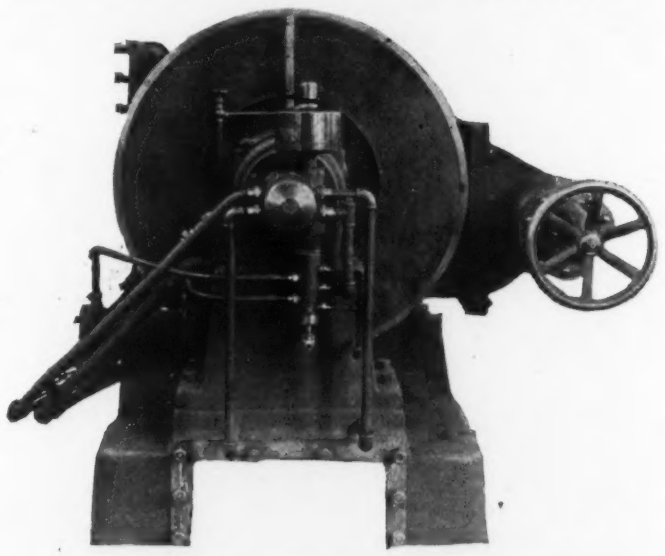


FIG. 3.—VIEW OF GOVERNOR.

into an economical non-condensing type, should the condensing apparatus get out of order or become inoperative. This is done by providing an auxiliary exhaust at a point favorable for exhaust to atmosphere. This early exhaust relieves the turbine from a certain amount of back pressure which would

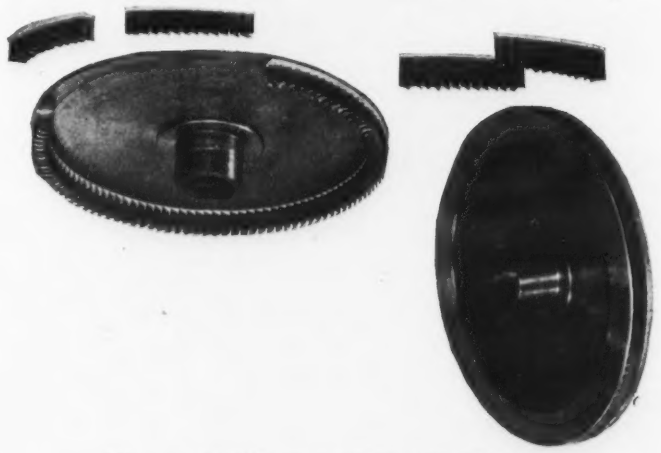


FIG. 4.—SECTIONS OF BUCKETS AND WHEELS.

arise from forcing a large volume of fully expanded steam through a number of useless and idle turbine wheels, causing a considerably reduced efficiency and other unfavorable effects. A narrow opening in the housing is provided for this auxiliary exhaust, a wider opening at the end being the exhaust to the condenser.

The builders have means by which the buckets to each of the wheels are cast in sections, all machining of these difficult and important parts being dispensed with. By the liberal use of fine polished, non-corrosive nickel steel, they claim to have succeeded in producing an inexpensive and very effective casing for runner-buckets as well as linings for nozzle openings, cast into attachable sections, as shown in Fig. 4. Assembling is facilitated by the fact that the turbine is made in separate, independent, standardized sections, easily bolted to each other in erecting. The usual practice of making parts in halves is not resorted to, and yet any part is readily accessible and can be easily replaced when repairs are necessary.

The builders are now prepared to supply units of not less than 400 kw nor more than 2,500 kw. A new type of alternator of excellent design, recently perfected by the Western Electric Company, will be used in connection with the turbine.

British Type of Meridian Lamp.

A type of the Meridian incandescent lamp is being introduced by the British Thomson-Houston Company to meet the demand for a lamp possessing all the characteristics of the original B.T.-H. spherical globe lamps, but having a globe of smaller diameter. It is not intended to occupy the same place as the Meridian, but to fill the gap between that lamp and the standard Edison 16-cp incandescent lamp. The new lamp is scientifically designed, accurately made and has a long, useful life, with but a

BRITISH MERIDIAN LAMP.

small consumption of power. The special "Prismo" glass shade is very efficient and is accurately fixed to the lamp holder by the use of a small shade carrier, or gallery, for attaching the shade to standard fittings, so that the lamp may be burned in any position—often an important consideration. The lamp has a rating of 32 to 35 cp with a power consumption of 60 watts. It is supplied with standard bayonet cap, special "Prismo" glass shade and gallery, and can be fixed in the ordinary fitting without alteration. It is made only in 4-in. frosted or obscured spherical bulbs, and for voltages of 100-125 and 200-250.

Liquid Tachometer.

The tachometer, illustrated herewith, has been designed for indicating revolutions per minute of motors, generators, shafting, etc. The readings are shown by the height of a colored liquid in the indicator tube in connection with a graduated scale. The only moving part in the instrument is the paddle wheel in the centrifugal pump, the latter constituting the lower part of the instrument. When the paddle wheel is revolved, the centrifugal force draws down the liquid in the reservoir and forces it up in the indicator. The bottom of the reservoir

communicates with the center of the pump, and from the periphery of the pump there are passages to the indicator tube.

The vertical height between the surface of the liquid in the indicator tube and of that in the reservoir will be approximately proportional to the square of the speed of revolution. The reservoir is concentric with the indicator tube, so that a slight inclination does not vary the level of the liquid in the tube. The small handle at the front of the instrument may be used for throttling the passage from the pump to the indicator, to prevent the vibration of the column of liquid due to sudden fluctuation in the speed. Thus, if desired, the readings may be made "dead beat." A displacement plunger is provided for adjusting the zero level of the liquid. Pure alcohol, colored with analine dye, is used.

Fig. 2 shows the course of the liquid when the instrument is in operation. From the reservoir the liquid flows down through the chamber where the displacement plug is located, down into the space surrounding the pump chamber. Passages conduct the liquid to both sides of the pump casing. When the pump paddle is revolved, the liquid enters the pump chamber through four small apertures on each side of the casing, close to the shaft. The centrifugal action of the paddle wheel whirls the liquid from the center to the periphery of the pump chamber, forcing it out through a number of small passages into the equalizing ring, thence up through the throttle or choke valve into the indicator tube, the rise being dependent upon the speed at which the paddle is revolved.

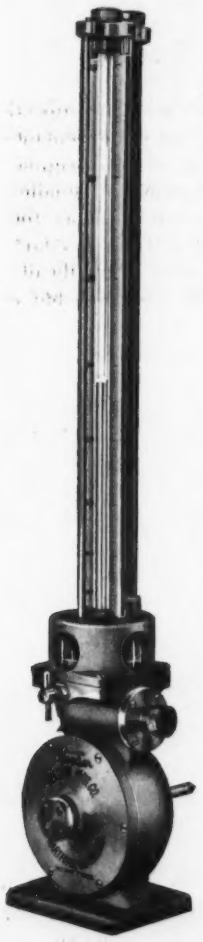


FIG. 1.—TACHOMETER.

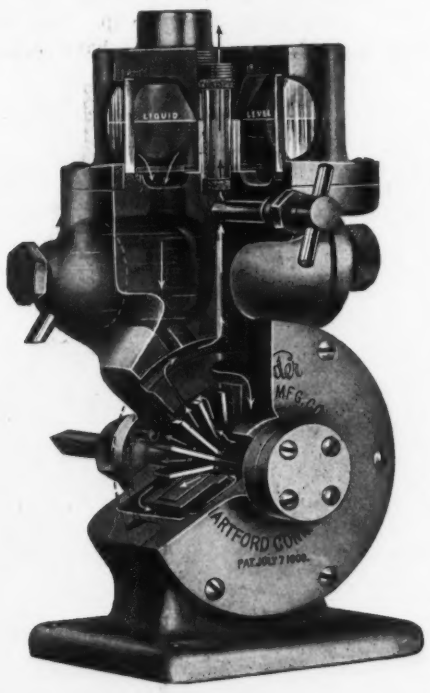


FIG. 2.—CUT-AWAY VIEW OF TACHOMETER.

The construction shown provides against any inaccuracy of the reading due to the wear of bearings. Even if, through long usage and wear of the bearings, the paddle or shaft were to become eccentric or displaced in the case, the accuracy of the readings would be unaffected, since the equalizing ring passages would compensate the irregularities. As the wear of the hardened steel shaft in its bearings is the only mechanical wear to which the instrument is subjected, no springs being employed, it will be seen that with the elaborate provision made for such wear as may occur, long service will not lessen the trustworthiness of the readings.

The standard length of scale is 12 in., for fixed maximum readings of 500, 1,000, 1,500, 2,000 or 2,500 revolutions per minute, respectively. When the tachometer is intended for general use a ball thrust bearing is provided on the end of the shaft. It is made by the Veeder Mfg. Co., Hartford, Conn.

Electric Heating Iron.

W. J. Barr Manufacturing Company, of Cleveland, is manufacturing an extensive line of electric heating appliances. Among these is the Eureka line of flatirons, which are made in thirty different styles from the small traveler's iron, weighing 3½ lb. to the heavy tailor's goose, which weighs 30 lb. Special attention has been given to appearance in the manufacture of this iron and artistic lines and high nickel polish make it very attractive. In the design of the heating element special attention has been paid to efficiency and length of life, and it is claimed that the heating element of the Eureka will last for ten years with a reasonable degree of care. In case of accident or burning out, the renewal can be made by anyone with the use of a screwdriver, as the top is not connected electrically with the bottom and the heating element is held by a screw. Another important feature in the construction of the iron is that the entire surface of the bottom is covered by the heating coil. The coil not only covers the entire bottom, but extends down to the point where it is most desirable to have good heat. One of the recent improvements made in the iron is a patent spring cord protector, which relieves the strain on the cord where it enters the iron, and makes it impossible for the cord to wear off at this point.

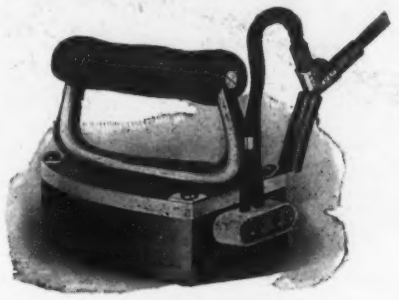


FIG. 1.—ELECTRIC HEATING IRON.

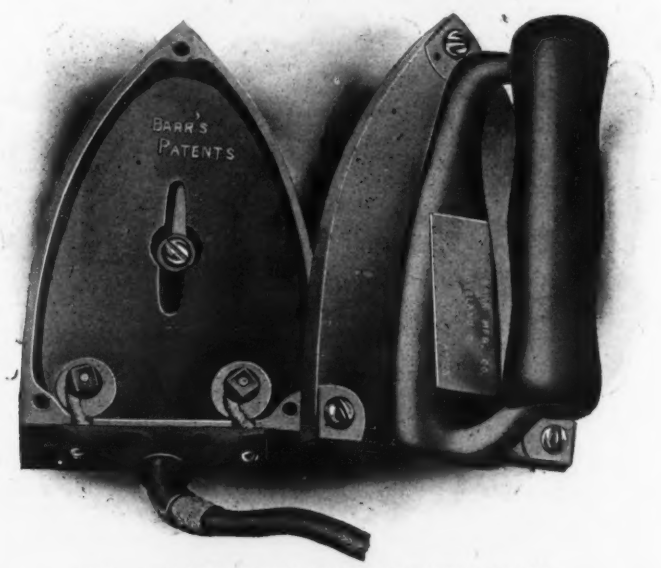


FIG. 2.—ELECTRIC HEATING IRON TAKEN APART.

In order to supply the needs of residents of those cities where the fire underwriters require an automatic cut-off when the iron is not in use, the company has recently brought out a patented device for this purpose. Instead of being in the handle, where it is difficult to repair in case of accident, the automatic feature of the Eureka is encased in a small nickel box, the front plate of which can be taken off and any of the parts removed and replaced by the use of a screwdriver.

The company has recently sent out some literature outlining a plan for co-operating with central stations in the sale and distribution of these irons and other apparatus. It has successfully introduced this plan to a large number of central stations in all parts of the country.

Laying New York Central Cables.

On May 12, 13 and 14 there were laid in the Harlem River, just east of the New York Central & Hudson River Railroad bridge, 19 cables as described below, under the direct supervision of W. H. Rodier, superintendent of construction of the Safety Insulated Wire & Cable Company, and in the presence of E. B. Katte, electrical engineer, and J. D. Keiley, assistant electrical engineer of

FIG. 1.—CABLE HOUSE.

the New York Central & Hudson River Railroad Company. The power cables were manufactured by the Safety Insulated Wire & Cable Company, the telephone cables by the John A. Roebling Sons' Company and the signal cables by the Okonite Company. Owing to the exceptional facilities of the Safety Insulated Wire & Cable Company, the armoring and finishing of cables in all cases was done at the works of the Safety Insulated Wire & Cable Company, at Bayonne, N. J., its plant being located on tide water.

The cables were laid eight at a time—the first time this has been accomplished successfully—and to insure that they were in proper position in a trench that had been dredged across the

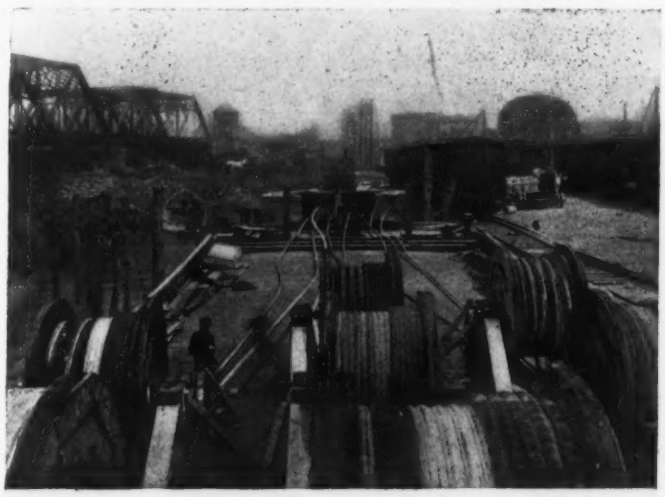


FIG. 2.—CABLES ON SCOW READY TO LAY.

river, a diver was sent down and his investigation proved that all the cables were in exact position.

Following is a description of the cables:

Four lengths, approximately 730 ft. each, of three-conductor No. 4-0, each conductor composed of 19 strands tinned copper wire, insulated with 13/64-in. wall of 30 per cent fine, pure Para rubber, taped. The three conductors thus insulated and taped are laid up with jute, covered with 13/64-in. jacket of same compound, covered with tape, 9/64-in. lead, sheathed, juted and armored with No. 4 galvanized-steel wire and finished with two layers tarred jute over all. This cable was tested at 40,000 volts for five minutes, and showed an insulation resistance of 2,000 megohms per mile. The weight per foot is approximately 18 lb. and the outside diameter 3⅞ in. This cable is designed for a working pressure of 11,000 volts.

Five lengths, approximately 750 ft. each, 1,000,000 cir. mils, composed of 91 strands insulated with 7/64-in. wall 30 per cent pure Para rubber, taped and covered with 9/64-in. lead, juted and armored with No. 4 galvanized-steel wire, with two layers of jute over armor. The cable was tested at 5,000 volts and is designed for a working pressure of 600 volts. The insulation resistance is 500 megohms per mile, weight of cable approximately 12 lb. per foot, and the outside diameter over all 2 9/16 in.

One length, 730 ft., 1,250,000 cir. mils, composed of 127 strands

FIG. 3.—LAYING POWER CABLES.

and approximately same specifications as the 1,000,000 cir. mil cables. The weight is approximately 13 lb. per foot and the outside diameter 2 11/16 in.

Four cables 700 ft. long, 1,250,000 cir. mils bare, composed of 127 strands; weight, approximately 4 lb. per foot. Three cables 710 ft. each for signal cables. Two telephone cables, 730-ft. lengths, one 10-pair and one 30-pair.

Cast-Iron Exhaust Head.

The Hoppes Manufacturing Company, Springfield, Ohio, is placing on the market a new exhaust head which is made entirely of cast iron with the exception of the drain pipe. The apparatus, as will be noted from the accompanying illustration, is symmetrical in design and liberal in its proportions. The principles involved in the construction are those used in the company's well-known steam separators and oil eliminators. Intercepting

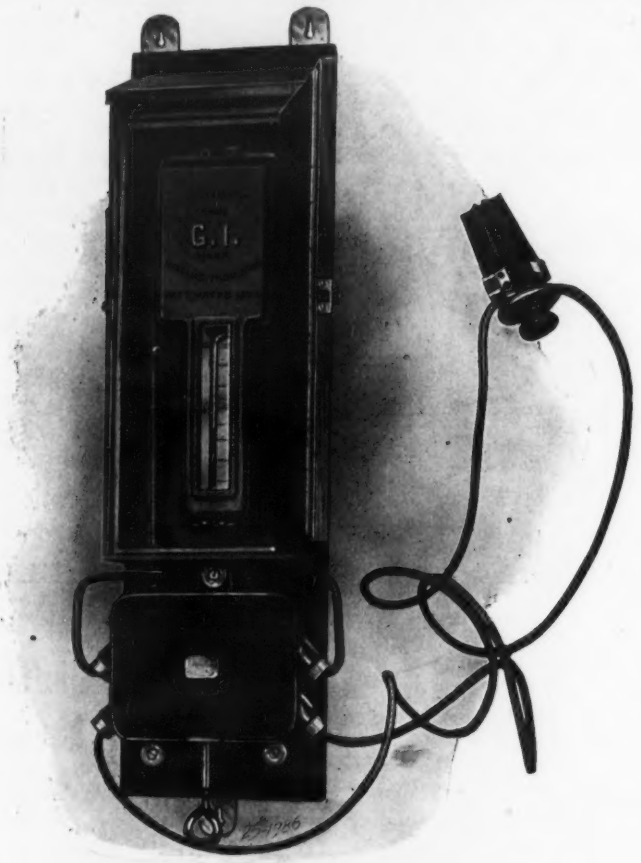
EXHAUST HEAD.

troughs partly filled with water prevent entrained water and oil in the exhaust pipe from passing through and falling on the roof of a building, while the cone in the center prevents excessive moisture in the steam from passing out without coming into contact with the inner surface of the head and having the moisture and oil removed. A special feature is an annular groove surrounding the outlet, which prevents condensation and oil from running over and down the outside of the head and pipe.

The exhaust head is made in sizes for pipe up to 48 in. in diameter. Being constructed of cast iron, which is impervious to the deteriorating influence of gases and the atmosphere, it is free from the corrosive action to which sheet metal is subject.

Portable Maximum Demand Indicator.

The Stanley-G. I. Electric Manufacturing Company, of Pittsfield, Mass., has recently placed on the market a special portable outfit for the use with the Wright demand indicator in outdoor



PORTABLE MAXIMUM DEMAND INDICATOR.

work, which is shown in the accompanying illustration. The outfit includes a weather-proof housing and insulating board fitted with hangers to be attached to the cross arm of the pole beside or near the transformer. Mounted at the bottom of the board is a "Wood" arc circuit cut-out which serves to shunt the indicator and to disconnect it from the circuit without interrupting the latter. The attaching plug is permanently connected to the indicator leads so that the entire equipment is self-contained and may be removed intact. To test a transformer it is only necessary to install the equipment on the cross arm and substitute the attaching plug for one of the fuse plugs from the primary fuse box. The indicator will show the maximum load which the transformer has had to carry since it was connected. The instrument may be connected in either the secondary or the primary circuit.

Steam Superheaters.

Within the last few years no greater step has been taken in the increase of steam plant efficiency than by the introduction of superheated steam. Great interest is being taken in this development by progressive engineers and the fuel economies resulting from its adoption have been very pronounced.

One of the types of apparatus for this service is the Foster superheater, illustrated in the accompanying cuts. The construction is clearly indicated in Fig. 1, which shows a pair of elements and the return header connection. Each element consists of a seamless drawn-steel tube, *A*, on which are shrunk cast-iron rings, *B*. Inside the tube, *A*, is placed an inner or spreading tube, *C*, closed at one end, which thereby forms a thin annular space between *A* and *C*, through which the steam flows. The tube, *C*, is held central in the tube, *A*, by spacing rivets, *D*. Tube *A* of each element is expanded into a cast-steel header.

This construction makes the apparatus capable of withstanding very high pressures, as the strength of the tube, *A*, is greatly increased by the shrinking on of the cast-iron rings, while it will be noted that these rings completely protect the tubes from

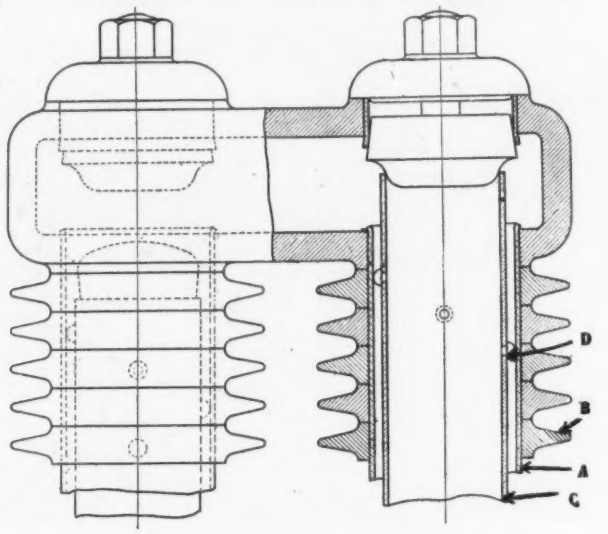


FIG. 1.—DIAGRAM SHOWING CONSTRUCTION.

contact with the flame. Owing to this latter feature, no flooding device is necessary to protect the superheater while steam is being raised in a boiler, and the attachment of the superheater to a boiler does not call for any change in the method of operating the boiler plant.

This type of superheater is made for attachment to any type of boiler and can be easily installed in existing plants. It is also made in separately fired units to meet different requirements of superheat from the same boiler plant and to superheating exhaust steam for various purposes.

Fig. 2 shows a horizontal return tubular boiler equipped with the Foster superheater. In this type of boiler the superheater is placed in the combustion chamber in the rear of the boiler. In water-tube boilers the superheater is placed in the path of the gases after they have made the first pass, or is placed so that part of the gases are shunted directly from the furnace through it.

A great advantage arising from superheating is that the steam

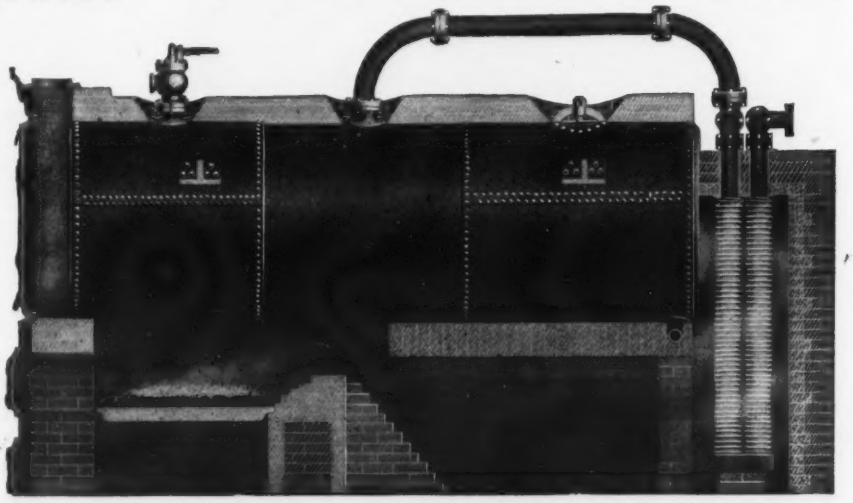


FIG. 2.—BOILER EQUIPPED WITH SUPERHEATER.

is delivered to the engine perfectly dry and free from moisture, and in cases where steam has to be conducted long distances, the absence of moisture in the steam as delivered to the engine is a very important factor in the proper operation of the machinery.

The Foster superheater is manufactured by the Power Specialty Company, 111 Broadway, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The rains of the past week had a quieting effect upon retail trade, which, however, is usually dull at this season. Taken as a whole, the month of May was a very active one in retail and wholesale trade and industry, in which the best records of preceding years were surpassed. Crop reports are irregular, due to uneven distribution of rainfall. Winter wheat conditions, on the whole, are about equal to those of a year ago; corn, though backward, has been helped by rains, while the cotton area will be larger and the condition better than a year ago. Building has been active, with corresponding effect upon the market for material. The labor situation in general is quite favorable. Settlements in the Western soft-coal fields are indicated, but the iron molders' strike is an unsettling element in the market for foundry iron. Finished products are reported quiet, but business in steel rails for future delivery is still active. Structural material is being freely ordered by railways, but general demand is comparatively quiet. Money is returning from the Pacific coast and is easier as a whole, though collections share the irregularity noted in retail demand. Railway returns are still in a high degree favorable. Copper is strong, with a good foreign demand for August delivery. One interest, it is stated, disposed of 1,500,000 pounds of electrolytic for British account on Friday at 18¾c. net at London, for August delivery. Heavy buying of Lake and electrolytic for September shipments is expected by domestic producers from this week's European market. For home market account buying is moderate. The larger consumers are covered for Lake, electrolytic and casting under deliveries up to September. Several domestic proffers for August electrolytic are in the market, but there is little metal available for September. A buyer of Lake, it is said, paid 19¼c. for 600,000 pounds, to be shipped in August. Casting copper continues in large request for all grades. Current quotations are: Lake, 18⅞ to 19c.; electrolytic, 18¾ to 18⅞c.; for August and September, casting copper, best grades, in large tonnages for thirty days' shipments, 18⅝ to 18¾c. Exports of copper for the first five months of this year were 25,174 tons less than in the same time last year, with a total for the first five months of this year of 82,531 tons, compared with 107,705 in the corresponding period last year. Exports for May this year were 18,860 tons, against 23,758 tons in the corresponding month last year, a decrease of about 5,000 tons. *Bradstreet's* reports 127 business failures in the week ending May 31, against 170 the week previous and 154 in the corresponding week last year.

ELECTRIFICATION OF THE WEST JERSEY.—Work on the construction of the electrified section of the trunk line railroad between Camden and Atlantic City is progressing rapidly. It will be remembered that the contract for the equipment and construction of this road was let to the General Electric Company last December, and that the equipment was to be in operation by July 1, 1906. When the magnitude of the work is considered, the necessity for rapid and systematic construction can be realized. In the first place, the work must not interfere with the regular operating schedule of the present steam trains. As a consequence, much track work has been done during certain hours at night. In addition to track work, bonding and pole-line construction, an 8,000-kw generating station and seven separate sub-stations are being erected and equipped. Progress on some of the sub-stations has been phenomenal. At South Camden, Glassboro, Newfield, and Reega, the sub-stations are well under way, each containing two 750-kw rotary converters with auxiliary apparatus, with arrangements for a third complete set. At Mizpah and Clayville the equipment consists of two 500-kw rotary converters, with room for a third, while at Atlantic City two 750-kw machines are being installed, with an ultimate equipment to consist of two additional 1,000-kw units. The eighth sub-station is at the main generating plant, and contains two 750-kilowatt rotary converters. The progress of the work will be clearly evident to visitors during the Atlantic City conventions. The third-rail construction has progressed rapidly, the over-running type of rail being mounted on reconstructed granite insulators. At crossings special jumper cable construction is employed. The cable is laid in bituminized conduit, itself embedded in cement. The cable ends in a bonding terminal, by which it is connected to the third rail. A terra-cotta cap completely protects the cable entrance of the conduit from the weather. The bonding on the 140 miles of track is well in hand. In conjunction with the third rail and track bonding, a double transmission line is being run on a single set of poles. The conductors are arranged on two cross-arms, with the three respective three-phase wires on each side of the pole in the usual triangle. A ground wire extends along the top of the pole line. Current for the transmission circuits will be generated by three 2,000-kw Curtis steam turbines at 6,600 volts, and stepped up to 33,000 volts for transmission. At the sub-stations the rotary converters will deliver direct current to the third rail at 650 volts. With few exceptions the over-running third rail will be used throughout. In Camden and between Newfield and Millville the over-head trolley will be installed.

SINGLE-PHASE EQUIPMENT.—The Anderson Traction Company, of Anderson, S. C., is now actively engaged in building the first section of an interurban road which will eventually connect the city with Greenville, 35 miles away. Anderson is the center of the cotton mill district in the South and the new line will place it in touch with the surrounding cotton mill towns as well as in closer connection with the main line of the Southern Railway. In the city there is already a direct-current railway and the first branch of the interurban is a continuation of the present lines as far as Belton, a distance of ten miles. Complete station apparatus and motor equipments for single-phase operation have been ordered for the extension. The new cars are of the heavy interurban type and are each equipped with four 75-hp, single-phase motors, adapted for operation at 3,300 volts alternating current on the interurban section of the road and at 550 volts direct current on the present direct-current city lines. Each car is fitted with air brakes, for which the motor compressors are adapted for operation on either direct or alternating current, this apparatus as well as the car motors and equipment being furnished by the General Electric Company. Power will be purchased from the Savannah River Power Company, delivered at a sub-station in Anderson at 66⅔ cycles. In the sub-station there will be a three-unit motor-generator set, consisting of an induction motor driver, direct-connected to an alternating-current generator for the single-phase portion of the line and a direct-current machine to supply the present city line. The driving motor consists of a two-phase, 66⅔-cycle, 1,150-volt induction motor, receiving its current from the 66⅔-cycle supply above mentioned. Direct-connected to this is a 300-kw, 25-cycle, single-phase, 3,300-volt, alternating-current generator which will furnish the ten-mile single-phase section now under construction with current directly to the trolley at 3,300 volts, without sub-stations. The remaining machine for furnishing the direct current consists of a 250-kw, 600-volt railway generator, complete with an exciter on the same shaft as the other three machines. The officers of the Anderson Traction Company are: Mr. J. A. Brock, president; Mr. F. G. Brown, vice-president; Dr. Geo. E. Coughlin, general manager. The road is being constructed under the direction of Mr. J. E. Sirrine, engineer, of Greenville, S. C., with Mr. E. F. Lilly, of Columbia, as consulting electrical engineer. General Electric Company apparatus is being used throughout.

HEANY FIRE-PROOF WIRE.—An important meeting of the Heany Fire-proof Wire Company, a new local industry of York, Pa., was held on May 29, when the American patents on insulated wire and the machinery for its manufacture were acquired from the Teter-Heany Development Company, which has perfected the new method of wire insulation. Plans were suggested at the meeting for launching the new company, and application has been made for a charter. The new industry will be an important addition to the manufacturing interests of York. A plant giving employment to a large number of persons will be established somewhere near the town. Capital from York, Hanover and other towns is interested in the new venture. Persons who have been mentioned in connection with the new venture are Hon. W. F. Bay Stewart, Hon. D. F. Lafean, R. H. Shindle, W. H. Griffith, Frank Lehman, John E. Baker, and Dr J. Frank Small, all of York; ex-Sheriff A. R. Brodbeck and Dr. J. W. Bittenger, of Hanover; Hon. Harvey Haines, of Yorkana, and Joseph Velt, of New York City.

MICHIGAN CENTRAL WORK.—The date of opening bids for the power and electric equipment for the Michigan Central Railroad has been extended from June 1 to July 1. The specifications cover the power station and substations and the installation of machinery and all material for electric traction, including water tube boilers, turbo-generators, surface condensers, electric traveling cranes, boiler feed pumps, horizontal feed water heaters, turbo-exciters, induction motors, mechanical stokers, coal and ash handling machinery and submerged vertical centrifugal pumps direct connected to motors. The part of the line that is to be electrified is that connected with the proposed new tunnel under the Detroit River.

CONDUIT FOR TORONTO.—G. M. Gest, the expert subway contractor of New York and Cincinnati, has closed a contract, through his New York office, for the construction of 500,000 feet of conduit for the Toronto Railway Company at Toronto. This will complete the subway system for that company, and will give it one of the most complete underground conduit systems of the kind.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was heavy and there was little speculative activity, the comparatively easy money obviating liquidating tendencies. At the close of the week the market was languid, with a fairly firm tone. The electric and tractions were generally stronger, with higher prices commanded at the close of the week. Allis-Chalmers common and preferred closed at 23⅜ and 60⅜, the former representing a net gain of 2⅜ points and the latter 2⅞. General Electric closed at the highest point of the week—169¼—this being a net gain of 1¾ points, and Westinghouse was steady throughout the week at 158. American Locomotive common closed at 70¼, which is an advance of 1½ points; but preferred lost ½ point net, closing at 114. A narrow business was done in Brooklyn Rapid Transit and high prices were maintained, the closing quotation being 83, which is a net gain of 1½ points. Interborough-Metropolitan common closed at 51⅛, a net loss of ⅜ point, and preferred at 85¼, which is a net gain of ½. Western Union receded ¼ point, the closing quotation being 92½. The curb market was stagnant throughout the week, except for efforts to bid up the copper group. In Mackay and Chicago Subway, which had recently been run up sharply, there were manifest efforts to take profits. As a result, the latter reacted and Mackay closed higher at 75⅞, which is a net gain of 3½ points. Following are the closing quotations of June 5:

NEW YORK

	May 28	June 5		May 28	June 5
Allis-Chalmers Co.	22¼	22⅜	General Electric	167	172
Allis.Chalmers Co. pfd.	57¼	59	Hudson River Tel.	...	...
American Dist. Tel.	*39	25	Interborough Rap. Tran.	226	...
American Locomotive	69	70	Mackay Cos.	72¾	75⅛
American Locomotive pfd.	114	114⅛	Mackay Cos pfd.	73¼	74⅛
American Tel. & Cable	90	90	Marconi Tel.	42	...
American Tel. & Tel.	135	138	Metropolitan St. Ry.	*116	*112
Brookyn Rapid Transit	80¾	84	N. Y. & N. J. Tel.	...	...
Electric Boat	18	18	Western Union Tel.	92¼	92⅜
Electric Boat pfd	65	65	Westinghouse com.	156	159
Electric Vehicle	11	11	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	May 28	June 5		May 28	June 5
American Tel. & Tel.	137¼	138¾	Mass. Elec. Ry. pfd	68⅜	70½
Cumberland Telephone.	...	...	Mexican Telephone	4	3¾
Edison Elec. Illum.	246	246	New England Telephone	138	...
General Electric	...	172½	Western Tel. & Tel.	...	...
Mass. Elec. Ry.	20	20¾	Western Tel. & Tel. pfd.	90	...

PHILADELPHIA

	May 28	June 5		May 28	June 5
American Railways	52	51¼	Phila. Electric	7⅝	7⅞
Elec. Co. of America	11¼	11⅝	Phila. Rapid Trans.	25⅝	25
Elec. Storage Battery	72	74	Phila. Traction	98¾	98¾
Elec. Storage Battery pfd.	...	..			

CHICAGO

	May 28	June 5		May 28	June 5
Chicago City Ry.	160	160	National Carbon.	88	88
Chicago Edison	149½	..	National Carbon pfd.	120	117
Chicago Subway	57¼	...	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	...	...
Metropolitan Elev. com.	27	26			

* Asked

BELL TELEPHONE CAPITALIZATION.—The sub-companies of the American Telephone & Telegraph Company are most emphatically, says the *Wall Street Journal*, the property of the stockholders, rather than the bondholders. During the past two years, ended December 31 or January 31 last, the thirty-four operating sub-companies of the American Telephone & Telegraph Company increased their bonded debt but $100,000. During the same time the increase in stock was $57,781,122. Of the total increase in capitalization during the two years, amounting to $57,881,122, only .17 of one per cent was due to an increase in bonded debt. At the close of the 1903 year the total amount of bonds outstanding was $33,653,500, or 12.4 per cent of the entire capitalization. At the close of the last fiscal year the total of bonds was $33,753,500, or only 10.3 per cent of the entire capitalization. The thirty-four companies taken are identical with those mentioned in the last annual report of the American Telephone Company, with the exception of the Western Electric Company, which is a manufacturing company, and the Delaware & Atlantic, which is included for purposes of comparison. Of these thirty-four companies, nineteen, or more than half, have no bonded debt whatever. Seven of the companies have decreased their bonded debt during the past two years through the operating of sinking funds, and only three have increased their outstanding bonds. The total capitalization of the sub-companies in 1905 was $293,636,960 in stock, and $33,753,500 in bonds, making $327,390,460, or 21 per cent more than in 1903.

MONTREAL LIGHT, HEAT & POWER COMPANY.—The figures of the annual report of the Montreal Light, Heat & Power Company have already been noted. President Holt says that the directors have appropriated $251,818 of the year's surplus to provide for renewals and depreciation, and also $50,000 for the insurance fund. The latter now has at its credit $150,000. During the year $396,000 of the company's 4½ per cent bonds were issued. Of this amount $358,000 was used to repay the company 75 per cent of the amount expended for extensions in the gas and electric departments; $38,000 was used for the retirement of a like amount of the debentures of the Royal Electric Company. There were also issued $64,000 of the company's 5 per cent bonds to retire the balance of the outstanding bonds of the Standard Light, Heat & Power Company. The president states that the increased demand for power has caused the directors to decide to develop in the present season the power of the surplus water of the Soulanges Canal.

NEW YORK TRACTIONS.—The New York City Interborough Railway Company has opened the first section of its road to traffic. This portion of the line extends from the subway station at One Hundred and Eighty-first Street, Aqueduct Avenue, to Fordham Road, and thence by Fordham Road and One Hundred and Eighty-ninth Street to Bronx Park. Cars will also be run down the Southern Boulevard from One Hundred and Eighty-ninth to One Hundred and Eightieth Street and west on One Hundred and Eightieth to Third Avenue. This company is a natural feeder of the subway and elevated lines and of the Union Railway, which is owned by the Metropolitan Street Railway Company. In turn, it will derive a large part of its earnings from traffic delivered to it by these lines. Its Board of Directors is made up almost entirely of Interborough and Metropolitan Street Railway men, but the stock is apparently in private hands. An eight-cent transfer is issued between its lines and the elevated and subway lines.

INDEPENDENT TELEPHONY IN NEW YORK CITY.—The United States Automatic Telephone Company, with offices at 116 Nassau Street, New York, has applied to the Board of Estimate for a franchise in New York City. In its application the company states that it owns the patents of new telephonic devices, and promises that if the city will give it access to the existing subways and ducts, with only nominal rental charges, it will establish a telephone system at $12 a year for private residences and $24 for business houses, with a charge of 2 cents for pay calls in each borough and a 10-cent interborough rate. Mr. Elias E. Ries is president of the company.

DIVIDENDS.—The Butte Electric & Power Company has declared a dividend of 1 per cent on the common stock, payable June 15. The regular quarterly dividend of 2¼ per cent on the Chicago City Railway stock is payable June 30. Directors of the Union Traction Company, Philadelphia, have declared the regular semi-annual dividend of 2 per cent, payable July 2. A semi-annual dividend of $3 per share, payable July 9, has been declared by the El Paso Electric Company, a Stone & Webster property. The Boston Elevated has declared a regular semi-annual dividend on the preferred of $2 per share, payable July 2.

TWIN CITY RAPID TRANSIT.—The directors of the Twin City Rapid Transit Company, which operates the entire street railway systems of St. Paul and Minneapolis, have voted an issue of $2,100,000 additional common stock. The common stock previously authorized amounts to $17,000,000, and the company has outstanding $3,000,000 preferred. Privilege will be given to holders of common and preferred stock to subscribe for the new issue at par to the extent of 10 per cent of their holdings. The proceeds of the new issue will be used to pay for extensions to St. Paul and Lake Minnetonka.

GENERAL NEWS.

Construction News.

SKAGWAY, ALASKA.—The Town Council has passed an ordinance granting a telephone franchise to the Alaska General Electric Company.

PHOENIX, ARIZ.—The Phoenix Light & Fuel Company has recently substituted new enclosed arc lamps for the old open arcs for street lighting.

JONESBORO, ARK.—The City has purchased the electric lighting and water works plant of the Jonesboro Water & Light Company.

CAMDEN, ARK.—The electric light plant, which was owned by non-residents, is now the property of Camden citizens. The officers are E. Harper, president; Arthur Ellis, vice-president; George Belky, secretary and treasurer, and D. L. Ellis, general manager.

EUREKA SPRINGS, ARK.—The City Council of Berryville, 12 miles east of here, has granted a ninety-nine-year electric light franchise to the King's River Electric Power Company. This company was recently granted a similar franchise here. The King's River will be dammed at a point nine miles from here and six from Berryville.

LOYALTON, CAL.—The electric light system will be extended to take in the residence part of the city. A fire alarm system will also be installed.

LOS ANGELES, CAL.—Plans have been completed for a two-story brick telephone sub-station for the Pacific States Telephone & Telegraph Company at a cost of $14,600.

YREKA, CAL.—The Weed Lumber Company will construct a new power house, in which an 800-hp engine will be installed. Individual motors will be used in all the different stations.

LOS ANGELES, CAL.—Preparations are reported to be under way for the construction of a telephone line from Crafton, on the Southern Pacific to Salt Lake City, a distance of 1,000 miles.

LOS ANGELES, CAL.—The Coachella Valley Home Telephone Company, recently organized, will construct a telephone system connecting the towns through the Coachella Valley, the lines extending from Mecca to Indio.

SELMA, CAL.—The San Joaquin Light & Power Company of Fresno is extending its system to this town. The work of installing the local plant will be completed in a few weeks, when electricity will be furnished for lighting and power.

ANAHEIM, CAL.—The Valley Home Telephone Company, which is being formed in this city, will establish a telephone system covering all of northern Orange County. The company contemplates an expenditure of about $125,000 in this district.

SAN DIEGO, CAL.—The Home Telephone Company is planning to extend its lines into the Imperial Valley. The company proposes to build a line from Julian and Cuyamaca across the desert, thus affording direct telephonic communication with Los Angeles and San Diego.

MARE ISLAND, CAL.—Bids will be received until June 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yard, Mare Island, Cal., a quantity of naval supplies as follows: Incandescent lamps, ventilating sets, thermostat springs, wire, cable, voltmeters, electrical supplies, etc. Applications for proposals should refer to Schedule 593.

LOS ANGELES, CAL.—The new Kern River plant of the Edison Electric Company will be completed within 90 days. It will have a capacity of 20,000 kw, and will cost about $2,000,000. The plant was begun in 1902, at which time it was thought that the proposed increase of power would serve the company's demands for several years, but patronage has increased so rapidly that it has been necessary to install a 1,000-hp steam engine in the city in addition to the Kern River plant. This will be in operation in September. The Edison Electric Company is now supplying electricity for 20 cities and towns. About 18,000 acres of land in Southern California is irrigated by water pumped by electric power furnished by the company.

TELLURIDE, COL.—The Telluride Power Company has commenced work on its irrigation and power plant project in Montpelier Valley in Idaho. The company will expend about $3,000,000 on the system.

MERIDEN, CONN.—The Bradley & Hubbard Manufacturing Company is installing an electric power plant to operate and light its entire plant.

NORWICH, CONN.—The Commissioners of the municipal electric light plant are considering the question of installing enclosed arc lamps to replace the open arc lamps now in use.

FAIRFIELD, CONN.—Decisive steps have been taken toward the installation of electric lights in the town. It is stated that if arrangements are not made with the Bridgeport Electric Light Company by fall the village will have its own electric light plant.

NORWICH, CONN.—The report submitted by the Board of Gas and Electrical Commissioners to the Mayor, showing the receipts and expenses for the first year's operation of the electric and gas plant by the city, is said to be very gratifying. The gas and electrical department has paid into the city treasury during the current year $119,678, and shows a net profit to the city of $9,103. The Mayor has recommended an expenditure of $22,000 for further improvements to the plant, which recommendation was approved by the Council.

WASHINGTON, D. C.—Bids will be received until June 26 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the Navy Yards at Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies as follows: Schedule 577—Drills, hydraulic jacks, etc. Schedule 578—Electrical wire and supplies, bolts, steel plates and shapes, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

WASHINGTON, D. C.—Bids will be received until June 12 at the Bureau Supplies and Accounts, Navy Department, Washington, to furnish at the Navy Yard, at Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 570—Incandescent lamps, wire, conduit, interior mechanisms, electrical supplies, etc. Schedule 575—Brass and copper wire, etc. Applications for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster-General, U. S. N.

ATLANTA, GA.—The Georgia Railway & Electric Company is contemplating the construction of a line to Stone Mountain.

OCILLA, GA.—The municipal water works and electric light plant was put into operation, May 22. The combined plants cost more than $30,000. J. L. Thrash is superintendent.

BRUNSWICK, GA.—Mayor Hopkins has been appointed one of a committee to confer with the Mutual Water & Light Company regarding the purchase of the lighting plant by the city. The town of Brunswick has granted a street railway franchise to Mr. Neff and associates, to build an electric street railway system in Brunswick.

ATLANTA, GA.—The Atlanta, Griffin & Macon Electric Railway Company, which will soon be formally organized, will make application for right of way into Atlanta on streets now occupied by the Georgia Railway & Electric Railway Company. The plan of the company is to build a line from Atlanta to Macon, a distance of more than 100 miles. The men interested in the project are N. B. Drewery, of Spaulding County; W. J. Massee, Minton Wimberly and J. T. Moore, of Bibb County; N. P. Pratt, Clifford L. Anderson and W. A. Wimbish, of Atlanta.

DEPUE, ILL.—A franchise has been given to George Beyer by the Village Council, giving him the privilege to erect and operate an electric lighting plant in this village.

CARROLLTON, ILL.—Bids will be received until June 15 by E. Z. Curnutt, chairman committee on lights, for lighting the city with 47 arc lamps of 2,000-cp each. A 5-year contract and a 10-year franchise will be granted.

MASON CITY, ILL.—The City Council has been considering plans for a municipal electric light plant and bonds will soon be issued. Work on the plant will begin in the near future. The plant will cost about $10,000, and will be for street lighting only.

CHICAGO, ILL.—Plans have been completed for an addition to the Chicago Telephone Company's headquarters on the corner of Washington and Franklin Streets. The cost is estimated approximately at $750,000. Pond & Pond are the architects.

MORGAN PARK, ILL.—The village of Morgan Park has entered into a contract with the Drainage Board to purchase 125 hp of the sanitary district's electrical energy, when ready for use next January, at $2.20 per hp per month. The lease is for a period of twenty years. The power is to be used to operate the water and lighting system of the village.

CHICAGO, ILL.—The Drainage Board on May 29 directed Chief Engineer Randolph to prepare plans and procure bids for a transforming and distribution station for the hydro-electric power. It will be located at 48th Avenue and Robey Street at the end of the high tension transmission line which is to convey the electric power from Lockport to Chicago; the probable cost is $60,000.

INDIANAPOLIS, IND.—The Marney Electric Company has filed notice of increase of its capital stock from $90,000 to $150,000.

RICHMOND, IND.—The City Council has ordered the drawing up of an ordinance appropriating $35,000 for an additional unit for the municipal lighting and power plant.

EVANSVILLE, IND.—The A. and G. Telephone Company will build and operate independent telephone lines in Vanderburg, Posey and Gibson Counties. Cornelius Roeder is president.

INDIANAPOLIS, IND.—The Indianapolis, Crawfordsville & Western Traction Company has increased its capital stock from $2,000,000 to $3,000,000. The road will be completed in sixty days. Edward Hawkins is president.

COLUMBUS, IND.—The Central Union Telephone Company has commenced the construction of a $45,000 exchange building. The company will install a new and up-to-date switchboard and hang several miles of new cables.

EVANSVILLE, IND.—Work on the construction of the Evansville & Eastern Traction Company's line between this city and Rockport has been resumed. The line is expected to be completed and ready for operation by October 1.

DECKER, IND.—We are informed that Eugene Rush, of Decker, is the principal promoter for the proposed dam to be constructed on White River at Decker, for the Indianapolis Hydraulic Company. H. von Schon, of Detroit, Mich., is engineer.

EVANSVILLE, IND.—Plans for the underground system of the Cumberland Telephone Company have been approved by the Board of Public Works. The company will proceed at once with the letting of contracts for the construction of the conduits.

WINONA LAKE, IND.—The Winona Interurban Railway Company has completed its line from Warsaw to Goshen and the line is now in operation. The electricity is secured from the plant which operates the electric railway from Warsaw to Winona Lake. The company is now building an electric plant on the shore of the lake at a cost of $300,000.

JEFFERSONVILLE, IND.—A trust deed for $1,250,000 in favor of the Colonial Trust Company, of Pittsburg, Pa., has been filed by the Indianapolis & Louisville Traction Company to cover the cost of the construction of its line between Sellersburg and Seymour, which is the last link connecting Indianapolis and Louisville. Work has been commenced and will be pushed as rapidly as possible.

CRAWFORDSVILLE, IND.—The Indianapolis, Crawfordsville & Western Traction Company has filed a $3,000,000 mortgage in favor of the Central Trust Company, of Indianapolis. Of this amount $1,500,000 is available to be applied on the construction of the extension of the line from Crawfordsville to Danville, Ill. The More-Mansfield Construction Company has the contract. A. F. Ramsey, of Crawfordsville, is president.

MUSKOGEE, IND. TER.—This city is considering the construction of a dam on Grand River for electric power purposes, to cost about $100,000. The Commercial Club is interested.

TAHLEQUAH, I. T.—Water power is to be developed on the Illinois River near this place. H. von Schon, of Detroit, Mich., has made examination and is preparing a report. Frank R. Lewis, of Tallequah is president.

TISHOMINGO, I. T.—Water power developments are being planned by H. von Schon, of Detroit, Mich., on the Blue and Pennington Rivers in behalf of the Pennington Water Power Company. Stephen B. Treadwell is secretary.

BURLINGTON; IA.—Extensive improvements are being made in the plant of the People's Gas & Electric Company. Four new boilers of 500 hp each are now being installed; these with other improvements will cost about $20,000.

OSKALOOSA, IA.—The Oskaloosa & Buxton Electric Railway Company has authorized an increase in its capital stock from $500,000 to $750,000 and the purchase of the property of the Oskaloosa Traction & Light Company, pending the examination that is now being made.

TOPEKA, KAN.—A charter has been granted to the Southern Kansas Railway & Light Company, to construct a new interurban electric railway through southern Kansas and Missouri. The company has a capital stock of $4,000,000 and owns property valued at $500,000. The directors are R. C. Rawlins, L. Rosenthal, John J. Jones, Frank C. Dixon, of Chanute, and J. W. T. Stephens, of New Orleans. The headquarters of the company will be at Chanute.

DANVILLE, KY.—The contract has been let for an electric plant at the Kentucky School for the Deaf at Danville, Ky., and work will be started at once. The plant will cost $6,000.

LEXINGTON, KY.—The East Tennessee Telephone Company will make extensive improvements to its system in Frankfort. A common battery or central energy system will be installed.

LOUISVILLE, KY.—The Louisville Lighting Company is contemplating the construction of a distributing station on Third Avenue, which will cost, with other improvements, about $75,000.

NEW ORLEANS, LA.—It is announced that the plant of the Consumers' Electric Company will be ready for operation within six weeks. The plant is equipped with Westinghouse generators and machinery. The company is also building a sub-station on South Rampart Street, which will cost when completed $125,000. The company has just closed contracts for lamps, meters and transformers, which will cost over $100,000. Jules Dreyfous is president.

ROCKLAND, ME.—Work has commenced on the construction of the new Plymouth County Street Railway line from Rockland to Brant Rock. The new road will be about 14 miles in length and will connect the inland towns of Plymouth County with the shore resorts. The company intends to build the power station in Pembroke.

HYATTSVILLE, MD.—The Council has not yet employed an engineer to supervise the construction and prepare plans for the proposed electric light plant. Harry W. Shepherd is chairman lighting committee.

AMHERST, MASS.—The Selectmen have granted the New England Telephone Company permission to lay its wires underground in the center of the town.

GREAT BARRINGTON, MASS.—The Consolidated Company contemplates the extension of the Berkshire Street Railway to Canaan, Conn., a distance of about twelve miles.

FALL RIVER, MASS.—The Fall River Electric Light Company has applied for permission to lay a conduit from Hathaway Street to its sub-station on Hartwell Street. The work will commence immediately.

MANCHESTER, MASS.—The Manchester Electric Company, which has been in operation for two years, is reported to be in a very satisfactory condition. The company now has two hundred meters placed, with the number fast increasing.

NORTH ABINGTON, MASS.—The Electric Light & Power Company of Abington and Rockland is considering the question of extending its service to Hanover. The company may also provide electricity for the new Plymouth County Street Railway.

EAST CAMBRIDGE, MASS.—Bids will be received until June 19 by the Board of County Commissioners (Levi S. Gould, chairman) for furnishing material and installing a steam and electric combined generating set in House of Correction. For further information apply to Warren Crane, chief engineer, House of Correction.

PITTSFIELD, MASS.—Electrical engineers in the employ of the Consolidated Railroad have been making an inspection of the Hoosac Valley and Berkshire Street Railway systems preliminary to changes to be made in the power plants of each road. It is understood that the high tension current generated at the Berkshire power plant on East Street will be transmitted to Zylonite on the north and to Canaan, Conn., on the south, and that the Zylonite plant will furnish electricity for North Adams, Williamstown and the proposed extension to Bennington, Vt.

MARINE CITY, MICH.—The City Council has granted Messrs. Hart, Ottaway and Marshal an electric light franchise.

HILLSDALE, MICH.—The Bryan Telephone Company will run its lines into Hillsdale County from Pioneer, Ohio. The company is also seeking a franchise to enter the city of Hillsdale.

TRAVERSE CITY, MICH.—A company has been organized here, with D. J. Albertson, president, and William H. Umlor, secretary, with a capital of $50,000 for the purpose of furnishing electric power for manufacturing purposes.

ALEXANDRIA, MINN.—Engineers Claussen, Burch & Pillsbury, of St. Paul, have recommended the construction of an electric light plant.

STAPLES, MINN.—Claussen, Burch & Pillsbury, of St. Paul, have estimated the cost of water works and an electric light system for Staples at $43,000.

CANNON FALLS, MINN.—We are informed that bids have not yet been requested for the proposed power plant on Cannon River. They will probably be called for during June.

BEMIDJI, MINN.—Dr. W. R. Morrison and H. W. Haines, of Bemidji, have secured permission to build a dam 12 miles up Mississippi River in the town of Jones.

ST. CLOUD, MINN.—The St. Cloud Electric Power Company has been formed to construct a dam and develop power at St. Augusta. O. T. Hougen, of Grand Rapids, Wis., is secretary.

DULUTH, MINN.—The Missable Electric Company has been formed by Fred B. Spelman and others, of Duluth, to develop electric power in Lake County by constructing dams on Birch River and Birch Lake.

DULUTH, MINN.—The Board of Water & Light Commissioners has awarded to the General Electric Company of Schenectady, N. Y., the contract for installing an electric pump at the Lakewood pumping station for $16,000.

VICKSBURG, MISS.—Houston Brothers have applied to the City Council for a franchise to operate electric cars on all streets in the city, and to furnish electricity in the city.

YAZOO CITY, MISS.—Kirkpatrick & Johnson, of Jackson, have been engaged to supervise the construction of an electric railway, for which bonds have been provided by the city and are to be sold by E. J. Pourse, city clerk. Engines, electric equipment, cars and track material will be wanted.

HATTIESBURG, MISS.—A plan is on foot to combine the power plants of towns near Hattiesburg and to build and operate a line 40 miles long to connect Hattiesburg, Laurel, Eastabuchie and Ellisville. The enterprise will have no connection with the other lines.

KANSAS CITY, MO.—Burns & McDonnell, Dwight Building, Kansas City, have completed plans for utilizing the waters of Big Niagara River in Camden County and building a dam and established a plant for the purpose of generating electric power to be transmitted to Kansas City, which is about 118 miles distant, also all the surrounding towns.

JEFFERSON CITY, MO.—The Secretary of State has issued a certificate of increase of capital stock of the St. Louis Terminal Railroad from $100,000 to $1,000,000. This road was recently incorporated by interests allied with the McKinley Electric System of Illinois. The company has a bill pending granting it franchise rights for the St. Louis terminals.

TWIN BRIDGES, MONT.—The Madison River Power Company contemplates building another large power plant on the Madison River.

BILLINGS, MONT.—B. P. Moss contemplates installing a second telephone exchange in Livingston and also proposes to extend and improve the Moffatt telephone system.

LIVINGSTON, MONT.—The Bell Telephone Company contemplates the erection of a new local exchange building and making improvements to its system in this city.

MISSOULA, MONT.—Work has commenced on a $2,000,000 electric plant at Thompsons Falls on Clarks Fork in Montana, and the promoters of the enterprise contemplate extending their transmission lines into the Coeur d'Alene district. The company is now planning the development of 10,000 hp. The company has secured rights from the Government to build its pole line into the Coeur d'Alenes. J. Stout, of New York, N. Y., is financing the project.

LINCOLN, NEB.—At the annual meeting of the Citizens' Street Railway Company the directors authorized the construction of ten miles more

of street railway. The officers were authorized to purchase additional cars and construction material.

LINCOLN, NEB.—The Omaha, Lincoln & Beatrice Railway Company will soon commence to operate a portion of its line between Bethany and Lincoln. Electricity to operate the road will be purchased from the Lincoln Traction Company. A new power house is being built by the Lincoln Traction Company at a cost of about $30,000.

LEBANON, N. H.—The electric light plant of the Lebanon Electric Light & Power Company is to be entirely rebuilt. A new brick building is to be erected. The machinery to be installed is as follows: A new 150-hp engine, with a heating and condensing plant, two generators of 200-kw capacity each, an additional boiler of 150 hp, and a new switchboard. The cost of the work is estimated at about $17,000. It is planned to give a 24-hour service when the improvements are completed. W. S. Tucker has resigned as president of the company and George S. Rogers has been elected to fill the vacancy and Charles M. Hildreth has been elected vice-president. The president and superintendent, Herbert M. Tucker, will have charge of the construction work.

CORTLAND, N. Y.—The Inter-Ocean Telephone Company has purchased a site on East Court Street, on which it will erect a telephone exchange building.

EAST ORANGE, N. J.—The City Council has renewed its present contract for street lighting with the Public Service Corporation of New Jersey for one year.

CAMDEN, N. J.—At a recent meeting of the water committee, Robert Hollingsworth, chief engineer, recommended that an electric light plant be installed in the Morris Pumping Plant, stating that the cost would not exceed $2,000.

OSWEGO, N. Y.—The Empire Telephone Company contemplates making extensive improvements on its building on West Second Street, which will cost about $100,000.

WADDINGTON, N. Y.—A special election will soon be held to vote on the proposition of selling the village water works plant and the electric light plant to A. A. Logan, of Morrisburg, Ont.

OSWEGO, N. Y.—The Oswego River Power Company has commenced the construction of a transmission line along the east side of the river from Syracuse through Phoenix and Fulton to the Oswego city limits.

DUNKIRK, N. Y.—The Common Council has granted a 99-year franchise to the Dunkirk Street Railway Company for a surface system in fifty streets. The promoters are W. J. Sheehan, W. J. Hillery and others.

FT. WOOD, N. Y.—Bids will be received by Capt. G. C. Burrnell, Constructing Quartermaster, U. S. A., until June 22, for repairing power house and for constructing a coal shed addition to power house at this post.

NEW YORK, N. Y.—Bids will be received until June 11 by C. B. J. Snyder, superintendent of school buildings, for installing electric equipment in additions to and alterations in school 158, Borough of Manhattan.

DOLGEVILLE, N. Y.—Bids will be received until June 12 by Thomas George, village clerk, for constructing a concrete block building, with reinforced concrete floor and roof, to be used as a municipal power station. Charles E. Collins is engineer.

INWOOD, L. I., N. Y.—Steps are being taken for the establishment of a lighting district in the town. A committee has been appointed to investigate the subject, and will make a report at a meeting of the Inwood Improvement Society, to be held June 22.

ALBANY, N. Y.—The new contract for electric lighting which the City has entered into with the Municipal Gas Company, and by which the City will save $16,615 a year, will go into effect on June 21. This saving will enable the City to add 50 or 60 lamps to the present service within a short time. There are 690 lamps now in use. The new agreement permits the city to increase the service to 800 lamps after December 1, 1906, at the same rate as the original number, which is 27 cents per lamp per night. The contract is for five years. An ordinance will be introduced at the next meeting of the Common Council, which will permit the commissioner of public works to add the proposed lamps to the present service.

LOCKVILLE, N. C.—The Lockville Power Company, has been incorporated, with a capital of $100,000.

WILLISTON, N. D.—Bids will be received at the office of the U. S. Reclamation Service, Williston, until July 9 for the installation of steam and electric pumping plants and electric generating and transmission apparatus, including three pumping stations, containing centrifugal pumps of 20 and 30 cubic feet per second capacity, driven by steam engines and electric motors aggregating 1,200 hp; also two 300-kw steam turbine generating units, a 1,000-hp boiler plant, a 3-mile transmission line, etc. Particulars can be obtained from Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from H. A. Storrs, Electrical Engineer, at Williston, N. D.

LAKEWOOD, OHIO.—An election will be held on July 5 to vote on issuing bonds for water works and an electric light plant.

SANDUSKY, OHIO.—The Sandusky Telephone Company, of which George Frick is president, has increased its capital stock from $75,000 to $200,000.

LOGAN, OHIO.—The Logan Home Telephone Company, of Logan, has increased its capital stock from $50,000 to $75,000 and will make improvements to its system.

MARIETTA, OHIO.—The Parkersburg, Marietta & Interurban Railway Company is extending its Muskimgum line north for a distance of two miles to a new park, which it has laid out.

MALVERN, OHIO.—The Malvern Telephone Company, with a capital stock of $5,000 has been incorporated by T. E. Hoppel, J. A. Riehl, J. C. Lewis, Fred Smith and Geo. B. Richards.

SPRINGFIELD, OHIO.—A motion to establish a municipal light, heat and power plant has been introduced in the city council. There is a strong sentiment in favor of the proposition.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Valley Traction Company will soon place contracts for the construction of its line extending from Leavittsburg to Garrettsville, a distance of 13 miles.

FINDLAY, OHIO.—The City Council has granted a franchise to the Findlay-Marion Electric Railroad to operate an electric railway in the city. The company is constructing a line between Findlay and Marion.

COLUMBUS, OHIO.—A building permit has been issued for the erection of the new telephone building of the Central Union Telephone Company at the corner of Third and Lynn Streets, which will cost $90,000.

ALLIANCE, OHIO.—The City Council of Alliance has passed an ordinance placing the maximum price for electricity furnished to the citizens at 12½ cents per kw-hour and 5 cents per kw-hour to users of more than 30 kw-hours per month.

HARRISON, OHIO.—A receiver has been appointed for the Harrison Light & Water Company. The failure is the result of the defalcation of A. L. Rich, president of the company, who recently disappeared after issuing a lot of bogus bonds.

CLEVELAND, OHIO.—The Cleveland Heat & Power Company, recently incorporated by Otto Miller and associates, will erect a plant for supplying heat, light and power for several groups of buildings in the down town section of the city.

CLEVELAND, OHIO.—Bids will be received until June 11 by the Board of Public Service (A. R. Callow, secretary) for boilers, superheaters, stack, pumps, feed water heater and appliances for the extension of the municipal electric light plant.

PORTSMOUTH, OHIO.—The Portsmouth Street Railway & Light Company has placed a contract with the Westinghouse Machine Company for a 750-kw turbine for its railway power house. The station is already equipped with two 600-kw Westinghouse turbines.

CLEVELAND, QHIO.—It is stated that the Cleveland, Ashland & Mansfield Traction Company, which proposes to build a railway from a point on the Cleveland & Southwestern near Seville to Ashland and Mansfield will probably place contracts for the work within two weeks.

NILES, OHIO.—Bids will be opened in a few days for new equipment for the city lighting plant. The material to be purchased will include an engine, an alternating direct-connected generator and 150 series-alternating arc lamps. Bids are in charge of City Engineer Wilson.

CINCINNATI, OHIO.—The Tennis Construction Company has arranged for financing $250,000 of bonds for the Evansville Eastern Electric Railway, which is in process of construction between Evansville and Rockport, Ind. The road will be a combined steam and electric railway.

CLEVELAND, OHIO.—The Forest City Railway Company, of which Fred Albers is general manager, is now making arrangements for the purchase of cars, overhead equipment, and machinery for the power plant. The power plant will be a temporary affair to take care of the line on Dennison Avenue, now under construction.

STEUBENVILLE, OHIO.—It is reported that W. Carl Ely, of Buffalo, has purchased the property and holdings of the Steubenville Traction & Light Company. The deal includes the lighting and power plants, lines to Empire and Toronto, the city lines in Steubenville, together with Stanton Park. It is stated that the lines are to be extended and improved.

CLEVELAND, OHIO.—The Cleveland Electric Company contemplates extensive improvements to its system during the coming year, among which is the purchase of 50 additional cars at a cost of $250,000, a new generator and engine for the viaduct power station, which will cost $50,000, and expenditure of about $300,000 for track improvements and possible extensions.

COLUMBUS, OHIO.—An ordinance to provide for an issue of $140,000 in bonds for the purchase of additional equipment for the municipal electric light plant will probably be passed by the Council at its next meeting. The manager of the plant recently announced that unless additional equipment was purchased immediately that it would be necessary to cut out about 600 arc lamps.

TOLEDO, OHIO.—The directors of the Toledo-Ann Arbor & Detroit Railway have appointed a special committeee to arrange for the refinancing the project. The company has about 20 miles of track laid and considerable additional grading completed. The company became financially embarrassed through the recent failure of the Patrick Hirsch Company, of Toledo, which was financing the project.

CLEVELAND, OHIO.—The White Sewing Machine Company, which is building a large automobile plant in Cleveland, has recently purchased from the General Electric Company a 500-kw, three-phase, alternating-current generator and several induction motors. The plant will be one of the largest in the world of its kind and all machinery will be driven by motors. The power equipment will also include an Erie City Iron Works engine and boilers.

CLEVELAND, OHIO.—The Cleveland Worsted Company, of this city, which is erecting a large plant at Ravenna, Ohio, has contracted for one 600-kw General Electric three-phase generator, one 150-kw three-phase generator, two 50-kw direct-connected exciter sets, switchboard and induction motors for driving machinery. The larger generator will be driven by a Buckeye engine and the smaller machine by an Ide engine. The contracts were placed through George S. Ryder & Company, of Cleveland, consulting engineers.

LOVELAND, OHIO.—The electric lighting plant of the Loveland Citizens' Electric Company has been completed and commenced operation June 1. The equipment consists of two four-valve engines of 175 hp each, direct connected to 125-kw, 2,200-volt, 60-cycle, three-phase alternators and two Atlas water tube boilers. The company also operates the water works plant and system in conjunction with the lighting plant. The company has a capital stock of $100,000. Frank M. Couden, of Cincinnati, is president, and H. C. Hubbell, of Loveland, is secretary and general manager.

CINCINNATI, OHIO.—The Schoepf syndicate has placed a contract with the Westinghouse Electric & Manufacturing Company for four 2,000-hp steam turbines with electric generators, rotary convertors, switchboard appliances, etc. Two of the outfits will go to the Hamilton power station of the Cincinnati Northern Traction Company, as the two large generators originally built for that station have been transferred to the Medway station on the Appleyard lines. The other two equipments go to the Indianapolis & Western Traction Company, a line being built from Indianapolis to Terre Haute, Ind.

DESHLER, OHIO.—The plant of the Deshler Electric Light Company was recently thrown out of service by the boilers giving out and the smoke stack blowing down. The owners of the company notified the City that the plant would not resume operations unless the city would add ten more arc lights to the street lighting service. The city gave the company three days in which to make preparations in which to resume the service threatening to annull the franchise and give it to some other party. Sumner Cottingham, owner of the Crescent Telephone Company, has applied for the franchise and will probably get it. The town is in darkness at present.

OKLAHOMA, OKLA.—The Pioneer Telephone & Telegraph Company will erect a five-story building on Third Street and Broadway, at a cost of $125,000.

NEWKIRK, OKLA.—The Newkirk, Tonkawa & Southern Electric Railway Company has been granted a franchise by the County Commissioners of Oklahoma County to construct an electric railway on the public roads in that county. The company proposes to construct an interurban line from Newkirk to Oklahoma City.

PORTLAND, ORE.—The Mt. Hood Electric Railway Company has been incorporated by G. P. Copp, C. W. Callett and C. W. Miller. The capital stock is stated to be $5,000.

PORTLAND, ORE.—The Condor Water & Power Company, which owns a large electric plant on the Rogue River, has applied for electric railway franchises through the streets of several cities and towns in Jackson County and Grants Pass in Josephine County. Dr. G. R. Ray is president.

EASTON, PA.—An election will probably be held to vote on issuing bonds for placing electric wires in conduits.

YORK CITY, PA.—The Edison Electric Light Company, of this city, has decided to extend its system to the village of Hellam.

WASHINGTON, PA.—S. A. Gilmore, Attorney for the West Penn Railways Company, of Pittsburg, has filed applications for a number of electric light, heat and power companies for Washington County.

MEADVILLE, PA.—Bids will be received by the Water and Light Committeee until June 23 for electric light equipment to consist of engines, boilers, arc light generators, arc lamps, boiler feed pump, etc. H. Ellsworth is superintendent.

MEDIA, PA.—The Bell Telephone Company has placed a contract with John Stuckert, of Philadelphia, to construct a new telephone exchange building at the corner of State Street and South Avenue, which will cost about $21,000.

WELLSBORO, PA.—A contract has been made with the Wellsboro Electric Light Company to light the borough of Wellsboro for a term of five years, with not less than 30 series enclosed-arc lamps of 2,000 cp, and as many 50-cp. incandescent street lamps as the Council may direct. The price is $76 per year for each arc lamp and $25 per year for each incandescent lamp. The borough building, with the exception of the fire companies' room, is to be lighted free of charge.

WOONSOCKET, R. I.—The Woonsocket Electric Machine & Power Company is constructing a large addition to its power plant.

CLINTON, S. C.—The Piedmont Electric Company, of Anderson, has secured the contract for constructing an electric light plant for $4,965. Charles C. Wilson, of Columbia, is engineer.

DEADWOOD, S. D.—Edwin N. Henderson, representing Chicago capitalists, proposes developing the old Home Telephone Company's system.

CHATTANOOGA, TENN.—The Chattanooga Electric Company has decided to expend about $75,000 for additional machinery. Byron T. Burt as manager.

KNOXVILLE, TENN.—An ordinance is before the Council requiring all telephone and telegraph companies to place their wires under ground in the first fire limit.

AUSTIN, TEX.—William Gallatin Carroll & Company have petitioned the city for franchise and right of way for a belt line of street railway in this city. The line is to be a continuation of the proposed interurban line between Austin and Lockhart which the company contemplates financing.

SALT LAKE CITY, UTAH.—Mayor Thompson has approved the Manley and Curtis franchise, for the installation of an electric system throughout the city.

EPHRAIM, UTAH.—The municipal electric lighting plant is completed and commenced operation May 27. The power plant is situated two miles east of the city; the equipment consists of a 150-kw General Electric three-phase alternating-current generator, direct-connected to Pelton water wheel operating under a head of 540 feet. The street lighting system consists of arc lamps of 1,200 cp each, and 132 incandescent lamps of 32 cp each. Service can be obtained twenty hours in the day. The plant was designed by Frank C. Kelsey, of Salt Lake City.

SUFFOLK, VA.—The Norfolk & Portsmouth Traction Company has just been granted a franchise in the town of Suffolk, Va., insuring local service in connection with the interurban service.

SPOKANE, WASH.—The Pend d'Oreille Development Company, of Spokane, has decided to construct a power plant at the new town of Metalline on Pend d'Oreille River.

SUNNYSIDE, WASH.—W. B. Bridgman, Mayor, writes that bids will soon be asked for the construction of water works and an electric light plant. The probable cost is placed at $16,000. O. L. Waller, of Pullman, is engineer.

MARSHFIELD, WIS.—The Council has in contemplation improvements to the water and light plant, to cost about $25,000.

PORT WASHINGTON, WIS.—W. G. Kirchoffer, of Madison, has been selected by this city to prepare complete new plans for water works and electric light plant, to cost about $75,000.

CHIPPEWA FALLS, WIS.—Lang & McNulty, of Eau Claire, have secured the contract for constructing a concrete dam at Kehl mill, for the Consolidated Milling Elevator & Power Company, for about $7,000.

MILWAUKEE, WIS.—Mayor Becker is planning to build a municipal light plant on a small scale on Jones Island. He proposes to secure power from the Jones Island pumping station, which lights the garbage plant.

ARGYLE, WIS.—E. J. Manning, of Monroe, has been employed by the Village Board to take charge of the construction of its water works and electric light plant. No contracts will be let, the Village Board will purchase all material in the open market.

MILWAUKEE, WIS.—The new municipal lighting commission was organized on May 21 with Irving B. Cary president, and Fred A. Landeck secretary. The matter of purchasing site and constructing municipal electric light plant has been referred to this commission. The commission now has $60,000 at its disposal to purchase a site for the plant, and will soon ask for proposals for the same.

CHILLIWAC, B. C.—A company of local men is being formed for the purpose of constructing some 70 miles of telephone lines through the Chilliwac Valley. Address, S. A. Cawley, care Cawley & Paisley, Chilliwac, B. C.

ALLAHABAD, INDIA.—The Allahabad Municipal Board is prepared to negotiate with applicants for the supply within the limits of the municipality, of electric lighting, fans and tramway. For detailed information apply to the Secretary of the Municipality. (H. V. Lovett is Chairman, Allahabad, India.) For copy of terms, apply to the office of Electrical World, 114 Liberty Street, New York.

CHATHAM, N. B.—The Council has decided to repair the electric light plant at a cost of $20,650 and has asked Engineers Lea & Coffin to prepare estimates in accordance with the specifications.

HALIFAX, N. S.—The Camaguay Electric Company has been incorporated with a capital of $350,000 to carry on a general electrical business, including the erection of a power plant. The directors are: R. V. Sinclair, A. F. May, C. T. Moffatt, Ottawa, Ont.

KINGSTON, ONT.—L. W. Shannon, City Clerk, writes that the citizens voted May 31 to issue $85,000 bonds to extend the power plant. J. M. Campbell is engineer.

MOUNT ALBERT, ONT.—The Mount Albert Telephone Company has been incorporated with a capital of $10,000. The provisional directors are: T. Graham, Township of Uxbridge, Ontario, and W. D. Stokes, Township of Scott, Ontario.

MONTREAL, QUE.—The Montreal Street Railway Company will erect two power houses, one in St. Henry ward and the other in St. Denis ward; also large car shops in Hochelaga ward, which will cost $200,000.

New Incorporations.

MONTGOMERY, ALA.—The Tidewater Development Company has been chartered, with a capital stock of $100,000 by J. M. Dewberry and others. The purpose of the company is to build electric railways in the State and develop water power. The headquarters are in Birmingham. J. M. Dewberry is president.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Nadeau Light & Power Company. It will have duplicate engines and generators of 750 kw capacity. The capital stock is $100,000. The directors are John A. Pirtle, Simon Maas, Walter A. Stone, J. M. Kellerman, J. T. Boyd, C. C. Gibbons and L. A. Mesmer.

DANBURY, CONN.—The Danbury & Port Chester Railway Company has been chartered with a capital stock of $100,000. The directors are John G. Parker, E. W. Buckland, of New Haven, Conn., and William E. Greenough, of New York.

MILLSTADT, ILL.—The West Side Telephone Company has been incorporated with a capital stock of $1,140. The company proposes to carry on a general telephone business. The incorporators are William Kropp, Jacob Fischer and G. A. Mueller.

MURPHYSBORO, ILL.—The Southern Illinois Transit Company has been chartered to build an electric railway from Murphysboro. The company has a capital stock of $5,000. The directors are Phillip Decker, A. J. Woodward, John L. Cox, W. F. Hughes and R. A. McCord.

ELKHART, IND.—The Elkhart Independent Telephone Company has been incorporated with a capital stock of $1,250. The incorporators are G. G. Taylor and others.

INDIANAPOLIS, IND.—The Indianapolis & Ohio Traction Company has been chartered with a capital stock of $10,000, for the purpose of building an electric railway from Bluffton to Decatur and thence to the Indiana-Ohio State line, a distance of twenty-four miles. The directors are Harry R. Moltz and J. B. Holthouse, of Decatur; J. R. Tudor, of Van Wert, Ohio; S. N. Young, G. A. Gessener and J. Y. Todd, of Toledo, Ohio.

MARION, IND.—The Citizens' Automatic Telephone Company, has filed articles of incorporation with the Secretary of State. The amount of the capital stock is $300,000. The company will at once construct and operate an automatic telephone exchange in Marion with telephone lines extending to the towns, cities and rural districts of Kosciusko and Marshall Counties. The directors are: O. L. Barge, E. K. Seymour, C. L. Fisher, Fred Edwards and James S. Sisson.

RAMONA, KAN.—The Ramona Farmers' Mutual Telephone Company has been incorporated with a capital stock of $3,000.

TOPEKA, KAN.—Articles of incorporation have been filed by the Topeka Electric Company, with a capital stock of $200,000. The incorporators are C. R. Maunsell and others.

MARION, MICH.—The Marion Electric Light & Power Company has been incorporated, with a capital of $250,000.

COLUMBUS, MISS.—The Columbus Light & Traction Company has been incorporated by L. Marx, G. T. Heard and others.

HATTIESBURG, MISS.—The Hattiesburg Home Telephone Company has been incorporated with a capital stock of $150,000. The incorporators are S. A. Jones, H. S. Stevens, L. J. Wetsel and others.

ST. LOUIS, MO.—The Century Lighting Company has been chartered with a capital stock of $100,000. The incorporators are T. P. Cronin and others.

TYRONE, MO.—Articles of incorporation have been filed by the Tyrone Local & Long Distance Telephone Company with a capital stock of $5,000. The incorporators are H. P. Clarke and others.

YUKON, MO.—The West Point Telephone Company has been incorporated with a capital stock of $2,170. The incorporators are A. C. Deming, J. H. Brass, O. D. Gardner, W. C. Gillespie and Lyman Allard.

JEFFERSON CITY, MO.—A certificate of incorporation has been issued to the St. Louis & Florissant Valley Railroad Company, of St. Louis, capitalized at $50,000. The incorporators are: Eugene C. Slevin, James W. Darst, Ben Blewitt, Charles A. Cunningham and Edward Schneiderhahn.

BENNETT, NEB.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000.

OMAHA, NEB.—Articles of incorporation have been filed for a new telephone company with a capital of $2,000,000. The incorporators are J. E. McPherson, F. W. Judson, C. J. Greene, W. C. Bullard, N. B. Updyke, H. H. Baldridge, all of Omaha, and G E. Woods, of Lincoln.

WATERTOWN, N. Y.—Articles of incorporation have been filed by the Watertown Light & Power Company with a capital stock of $1,000,000. The directors are J. T. Lynn, of Detroit, Mich.; J. D. McMahon, of Rome; C. C. Middleton, G. S. McCartin and E. R. Brown of Watertown.

GROVER HILL, OHIO.—The Country Home Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are J. M. Hutchinson and others.

GEORGETOWN, OHIO.—The Brown County Independent Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are Louis Nischler and others.

PAINESVILLE, OHIO.—A company has been formed for the purpose of building an electric railway from Painesville to Warren. S. Stoughton, of Painesville, is at the head of the company.

TORONTO, OHIO.—The Republic Telephone Company, with a capital stock of $25,000, has been incorporated by J. G. Gilgrist, Richard Gilsons, A. C. Jones, L. O. Smith and T. J. Campbell.

CADIZ, OHIO.—The Farmers' Telephone Company, of Cadiz, has been incorporated by A. M. McCombs, James Love, J. M. Megaw, S. E. Adams and Louis Peck. Capital stock is $2,000.

MARIETTA, OHIO.—The Mile Run Mutual Telephone Company, of this County, has been formed by W. F. Watkins, L. F. Wern, Jesse Thomas, John Swynne and Roger Fish. The capital stock is $3,000.

COLUMBUS, OHIO.—Articles of incorporation have been filed with the Secretary of State by the Wolverine Telephone Company with a capital stock of $4,000. The incorporators are F. E. Hoffee and others.

CLEVELAND, OHIO.—The Cleveland, Brooklyn & Elyria Railway has been formed with a capital stock of $100,000 by B. E. Ottaman and W. E. Elliott, of Cleveland; L. J. Weadock and J. H. Kniseley, of Toledo, and O. A. Thomen, of Elyria.

MOUNTAIN PARK, OKLA.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are H. L. Collins and others.

PORTLAND, ORE.—Bids have been opened by the Mount Hood Electric Company for the construction of the power plant on the Sandy River, and are being reviewed by the engineers. The plant will be located on Bull Run Site, and will generate 30,000 hp. Bids range from $650,000 to $800,000.

FAIRCHANCE, PA.—The Fairchance Light & Power Company has been incorporated with a capital stock of $30,000. The incorporators are M. A. McCormick and others.

SALT LAKE CITY, UTAH.—Articles of incorporation have been filed by the Garfield County Telephone & Telegraph Company, with a capital stock of $25,000. The company will construct a telephone line in Garfield County, with headquarters at Panguitch. The incorporators are H. M. Steele and others.

NORFOLK, VA.—The Eastern Light Company has been incorporated with a capital stock of $50,000, by W. H. Carr, president; Joseph H. Hopkins, vice-president; W. W. Miller, secretary, and J. R. Perry, treasurer.

PEARISBURG, VA.—The Giles County Electric Railway Company has been chartered with a capital stock of $25,000. The officers are: C. T. Painter, president; Thomas J. Pearson, vice-president; M. P. Farrier, secretary and treasurer.

CLARKSVILLE, VA.—The Eagle Falls Light & Power Company has been incorporated, with a capital of $5,000,000, to supply electricity in the states of Virginia and North Carolina. A dam will be constructed across Roanoke River, near Taylor's Ferry, Va. Henry G. Murray, of Baltimore, Md., is president.

CHENEY, WASH.—The Spokane, Cheney & Southern Railway Company will be incorporated with a capital stock of $150,000. Charles P. Lund is interested.

SEATTLE, WASH.—The American Electric Company has been incorporated with a capital stock of $5,000. The incorporators are George A. Hastings and others.

New Industrial Companies.

THE AMERICAN CONCRETE BUTT COMPANY, of Philadelphia, Pa., has been chartered with a capital stock of $2,000,000, to manufacture butt attachments for telegraph and telephone poles.

THE CLEVELAND ELECTRIC FIXTURES COMPANY, of Cleveland, Ohio, with a capital stock of $250,000, has been incorporated by B. G. Tremaine, W. C. Hine, R. W. Hine, H. A. Tremaine and J. B. Crouse.

Obituary.

MR. C. K. HILL.—We regret to note the death of Mr. Charles K. Hill, aged 35, president of the C. K. Hill Electric Company, and identified with other enterprises, who died in New York City last week, of appendicitis. Mr. Hill was born in Pittsburg, Pa., and was a son of the late George B. Hill, who before his death was one of the oldest and most enterprising business men of Pittsburg. About four years ago, when George B. Hill died, the son took charge of the business, which he conducted successfully. He was a director of the Central Trust Company, member of Dallas Lodge of Masons, of the Duquesne Club and Automobile Club, of Pittsburg, and New York Athletic Club. Mr. Hill's widow, who before her marriage was Miss McKeown, and three children survive.

MR. WILLIAM THOMAS BOUCHELLE, who died at his home in Greenwich, Conn., on May 19, was one of the pioneer telephone men of the country. He entered the service of the old Metropolitan Telephone & Telegraph Company of New York City over 22 years ago, and in the period that followed witnessed at close range the development of that great system of communication. His was an active part in this remarkable enterprise, and the presence of so many men at the funeral services, representing, as they did, such wide interest, testified to the high position in which he was held. He was born in Baltimore, Md., on January 22, 1848, came to New York in 1869, and entered the employ of Dodd's Express (now the New York Transfer Company), holding a responsible position with that company up to 1883. In the year of 1876 he married Miss Mary Ennis Woodruff of New York, who now survives him. It was not until 1884 that Mr. Bouchelle entered the service of the New York Telephone Company (then the Metropolitan Telephone & Telegraph Company). For 17 years he was connected with the executive office as confidential secretary and assistant to the president. His distinguished characteristics, unselfish fidelity and amiability, gave great value to his work, and won for him there a very large circle of friends. His business connections placed him in many responsible positions. In addition to the position he held with the New York Telephone Company, he was treasurer of the Empire City Subway Company, as well as a director of that company. He was also a director of the American District Telegraph Company, the Holmes Electric Protective Company, and the Northeastern

Telephone & Telegraph Company. His unfailing good nature and geniality was a rare gift. He was a member of the New York Athletic Club, the Fairfield County Golf Club, the Indian Harbor Yacht Club, as well as the Masonic, Royal Arcanum and other fraternal orders. Mr. Bouchelle was attentive to his duties, however, up to within a few days of his death. Although unknown to most of his friends, he had suffered for over a year from ulceration of the stomach, and while he was known to be far from well, his death was sudden and unexpected, the stricken man being conscious up to the end and recognizing those around him. The wide popularity of the man made the funeral necessarily large.

Educational.

UNIVERSITY OF MICHIGAN.—The board of regents has awarded to the Michigan State Telephone Co. contracts for the installation of a telephone system for the university buildings and campus. The proposition has been under consideration for several months and Special Agent E. V. Chilson, of Lansing, has spent considerable time there lately working out the details with Managers Krech and Harbough, of the local exchange, and the regents. As finally adopted by the regents the plans call for the installation of a complete model telephone plant, with from sixty to seventy-five stations or terminals, located in the different departments, which will be run to a switchboard to be located in the office of Secretary Wade. Trunk line facilities are also provided to the downtown exchange. The installation is to be made at once and the new system will be in working order for the opening of school in October. The proposition of the Michigan company to the university is a very generous one and means practically the establishment of a telephone course in connection with the engineering department. Every piece of apparatus that goes into the construction of the plant is to be duplicated and labeled and placed in a glass case, which will be presented to the university.

Personal.

MR. J. H. LAWTON, of Humboldt, Ia., has taken over the management of the electric light system at Alquona, Iowa.

MR. ERNEST LEE CLARK, of Waterbury, Conn., has accepted a position as electrical engineer with the New York, New Haven and Hartford Railroad Company, with headquarters at New Haven.

MR. ISAAC L. RICE, who is interested in a large number of electrical enterprises, has sailed for Europe. Submarine boat developments are said to be impending on the other side, requiring his presence.

MR. L. J. SCHLESINGER, former manager of the Muncie, Hartford & Ft. Wayne Company, has been appointed superintendent of motive power for the entire system of the Indiana Union Traction Company.

MR. H. H. COCHRANE.—Mr. Harry H. Cochrane who has been an instructor at Cornell University for the past three years, has resigned his place at the university to accept one as electrical engineer with the Helena Power Transmission Company at Helena, Montana.

MR. E. H. DUNLAP, superintendent of the municipal electric lighting plant, Columbia City, Ind., has resigned to accept a position with an electrical company in Bartow, Fla. Mr. J. E. Spicer, chief electrician of the municipal water and light plant at Napannee has been appointed to succeed Mr. Dunlap.

MR. FREDERICK C. R. SPENCE has severed his connection with the Stanley Instrument Company, Great Barrington, Mass., and is now with the Fort Wayne Electric Works, Fort Wayne, Ind. His headquarters are at Fort Wayne, and he is acting in the capacity of a special representative for the sale of meters.

MR. J. B. NEWHALL, hydraulic engineer, 114 Liberty Street, New York City, has been engaged to make an examination and report upon the water power at McKeevers Falls on the Roanoke River, near Brookneal, Va. The water power will be used for electric purposes and the energy may be transmitted to Lynchburg, Va., a distance of thirty miles.

MR. S. O. OCHS, who was formerly associated with the Stanley Instrument Company, is now representing the Fort Wayne Electric Works in its New England territory with his headquarters at Boston. He is well known to the electrical fraternity throughout the New England States, including New York. Mr. Ochs has just suffered a severe bereavement in the loss of his sister, who died in Kansas City recently.

MR. E. W. STEVENSON, electrical engineer and cable expert of the Hazard Manufacturing Company, of Wilkesbarre, Pa., has sailed for England with his family on the "Caledonia." He will stay a couple of months on the other side, which he has not visited for several years. Part of the vacation will be spent with his father, Mr. E. A. Stevenson, one of the staff of the Telegraph Construction & Maintenance Company. The rest of it will be taken up with the trip and hospitalities planned by the Institution of Electrical Engineers for its colleagues of the American Institute of Electrical Engineers.

MR. P. R. TODD.—Advices from New Haven, Conn., say that First Vice-President Percy R. Todd of the New York, New Haven & Hartford Railroad Company is to become head of a large electric railway enterprise in Canada. The project, it is stated, contemplates the construction of an electric road several hundred miles long, paralleling largely the Grand Trunk Railway and reaching several of the most import Canadian cities. Mr. Todd last November received leave of absence lasting for one year, until November of the present year, when his connection with the New York, New Haven & Hartford Railroad, it is understood, will cease.

MR. E. KOERTING.—At the celebration of the seventy-fifth anniversary of the Koeniglich Preussische Technische Hochschule of Hanover, Germany, one of the most prominent institutions of its class, the honorary degree of doctor of engineering was conferred on Mr. Ernst Koerting, the noted European engineer, of the well-known firm of Gebr. Koerting, A. G. Koertingsdorf, Hanover, for his scientific researches and discoveries in gas engines, and other important branches of engineering. Dr. Koerting lives at Pegli, Italy. He is interested in a number of large enterprises in the United States, among them the De La Vergne Machine Co., of New York, as well as the Schutte-Koerting Company, of Philadelphia, and is at present visiting the United States.

MR. R. PITCAIRN.—Mr. Robert Pitcairn, resident assistant at Pittsburgh to President A. J. Cassatt of the Pennsylvania Railroad, having reached 70 years, has gone on the retired list after fifty-three years in the employ of the company. His last day was spent receiving congratulations of friends, including a letter from Andrew Carnegie, his old fellow telegrapher. He entered the employ of the company as a telegraph operator at Altoona. In 1885 he succeeded Andrew Carnegie as superintendent of the Pittsburg division. Later he became general agent and finally resident assistant to the president. He will devote his time now to managing his private fortune, estimated at $20,000,000. He owns stock in hundreds of coal companies and other concerns along the Pennsylvania lines.

SOUTHERN BELL APPOINTMENTS.—Mr. W. B. Roberts, manager of the Atlanta Bell exchange, has been named as assistant superintendent of the second district, retaining an interest in the management of the Atlanta exchange; L. J. Oliver, manager of the Columbus, Ga., exchange, has been appointed superintendent of the seventh district, with headquarters at Charleston, succeeding Mr. Therrell; H. L. Smith, superintendent of the fifth district, with headquarters in Savannah, is made special agent to General Manager J. Epps Brown, of Atlanta, while David Laird, of Richmond, Va., manager of the local exchange, becomes superintendent of the fifth district, with headquarters in Savannah. Mr. D. M. Therrell, superintendent of the seventh district of the Southern Bell Telephone Company, has been appointed superintendent of the second district, with headquarters at Atlanta, Ga.

MR. CABOT STEVENS, for many years electrical engineer of the Edison Electric Illuminating Company of Brooklyn, severed his connection with that company, on June 1, having accepted a responsible position with Stone & Webster, of Boston. Mr. Stevens' associates in the Brooklyn Company heard of his decision with regret and on Tuesday, May 29, tendered him a farewell dinner at the Brooklyn Club. General Manager W. W. Freeman, General Superintendent Walter F. Wells and others expressed their appreciation of Mr. Stevens' character and services and voiced the unversal regret at his departure. Mr. Joseph Becker, Jr., superintendent of the meter department, on behalf of the staff council of the company and as some slight token of their esteem, presented Mr. Stevens with a diamond pin and link cuff buttons. Mr. Stevens' first work in his new field will be at Columbus, Ga., where he will represent Stone & Webster in the construction and operation of a large light, power and railroad plant.

Trade Publications.

KELLOGG SWITCHBOARD & SUPPLY COMPANY, of Chicago, Ill., has issued a neat little "Everybody's Rule Book," containing a lot of handy useful data in tabloid form, sandwiched in with information as to the telephonic apparatus manufactured by the concern.

THE SPRAGUE ELECTRIC COMPANY has just issued a new instruction book as to the method of installing the Greenfield flexible steel conduit and armored conductor. All the parts of this standard system are shown in detail and the instructions are carefully full and specific as to the proper way of installing the conduit.

DODGE & DAY, Drexel Building, Philadelphia, have just issued pamphlet No. 15, which describes and illustrates their work as improvement engineers on a large number of old and new industrial power plants, some of which are of a most interesting character, serving a larger field than the word "industrial" would imply, as for example, that of the Lehigh Coal & Navigation Company.

ALLIS-CHALMERS DEVELOPMENTS.—The Allis-Chalmers Company, Milwaukee, Wis., has reprinted from the Milwaukee *Sentinel* a description in detail of the development of its different departments. Views are given of the Chicago works Nos. 1 and 2, of the West Allis works, the Scranton works, the Reliance works and south foundry and the electrical department at Cincinnati.

ELECTRIC HOISTS.—The Yale & Towne Mfg. Company, 9 Murray Street, New York, has just issued an attractive catalogue dealing with electric hoists, which should prove of much interest to users of lifting apparatus. By means of a ball-bearing swivelling hook, the hoist may make a dragging lift at an angle of 45 degrees, thus covering a large floor area. All of the tensile strains are taken on wrought metal only, and the compressive strain on cast metal only. Turntable collector rings are used to permit the hoist to swivel continuously in one direction without twisting up the leads. A solenoid brake attachment allows the controller to be placed at a distant point when desired.

PEERLESS ELECTRIC COMPANY, Warren, O., has issued a neat circular devoted to its power motors. The bulletin is called "The Pigeon

Hole," and is illustrated with the motor operating a candy making machine, the motor being placed vertically under the candy maker, entirely out of the way of the operator. The circular makes some very good points as to the gain in cleanliness, economy, etc., in adopting direct drive.

HOT WATER BAGS.—The Standard Electric Heater Co., of Ozark Building, St. Louis, has issued a neat little circular devoted to its ingenious form of electric hot water bag heater. The ordinary stopper has associated with it a nickel-plated brass tube heating element which can be inserted in the bottle and which will thus keep the water hot indefinitely. It takes about 30 per cent less current than a 16-cp lamp. Each heater is furnished with 12 feet of lamp cord and a plug to screw into any lamp socket. The temperature maintained is 125° F. The device is quite inexpensive.

RUBBER PACKING.—The Mechanical Rubber Company, Cleveland, Ohio, has issued a profusely illustrated catalogue describing and setting forth the various qualities of the "Marco" packings. The cuts, which are made from actual photographs practically without retouching, give an excellent idea of each style of packing to which the descriptive matter refers. The printing is done in two colors, so that the different materials used in the formation of the packings can readily be distinguished. Complete instructions are given as to the selection and use of packing for various purposes.

WARD LEONARD DIMMERS.—New catalogues showing all types of Ward Leonard theatre dimmers have been issued by the Ward Leonard Electric Co., of Bronxville, N. Y. Cuts of both front and back of board interlocking theatre dimmers are shown. A complimentary letter received from the electrical engineer of the New York Hippodrome, reads as follows: "Enclosed we hand you our order for 124 dimmers, being the equipment used in the installation of our New York Hippodrome. This order we are placing with you without asking for competitive bids, having used your apparatus extensively for the last 5 years, and being confident that it is the most reliable apparatus of its kind on the market. We take great pleasure in saying that we are entirely satisfied with your apparatus, and care to look no further for this installation."

"BATTERY SPARKS" is the striking title of a 16-page pamphlet issued by the Edison Mfg. Company, Orange, N. J., and describing the Edison primary battery and spark coil for gas engines. The subject is gone into very extensively and figures are given showing the comparative cost of sparking an engine with Edison cells, dry cells and other classes of batteries. The Edison spark coil differs from most of those on the market in being wound with shorter and heavier wire and in transferring a larger proportion of the battery energy to the gas-engine cylinder. It is stated that it is the heat of the spark that fires the engine and not the voltage of the spark and that the arc drawn out by the contacts of the break-and-make sparking device is more effective than the thin, high-voltage spark of the jump spark arrangement, besides which, it is said, there is a great saving in the complication of the apparatus employed.

STURTEVANT ECONOMIZERS.—Bulletin No. 132, in the Engineering Series issued by the B. F. Sturtevant Co., Boston, Mass., illustrates and describes Sturtevant economizer installations in the power houses of the Interborough Rapid Transit Co., the New Orleans Railways Co., the Boston Elevated Railway Co., the South Covington and Cincinnati Street Railway Co., and the Burlington Municipal Electric Lighting Co. The Interborough installation includes 28 economizers sufficient for the 26,000 hp of boilers now installed. Those in the New Orelans plant are operating under the unusually high pressure of 225 to 250 pounds per square inch. The Boston Elevated Railway Co., after deciding to remove three of their economizers and put in new ones which should include features designed by its own engineers, found that the Sturtevant type embodied practically all of the suggested improvements. As a result these economizers were purchased.

EDISON PRIMARY BATTERIES are used in immense quantities, as for the operation of railroad signals, the sparking of gasolene engines and for places where a limited amount of electrical energy is needed constantly and unformly. The batteries now being supplied are an improvement over the old cells, and their manufacture and design have been reduced to scientific perfection. We have before us a pamphlet entitled "Edison Primary Batteries," published by the Edison Manufacturing Co., of Orange, N. J. This pamphlet describes Edison's improvement of the Lalande caustic potash cell, which, as the pamphlet shows by quotation from Prof. Carhart, "has a capacity of work per unit weight greater than any other either primary or secondary." It is stated that the energy of the Edison cell applied through a perfect motor would raise the cell 16.17 miles. The improvement made by Edison consists in forming the copper oxide depolarizer into firm briquettes which reduces both the internal resistance of the cell and the tendency to polarize, at the same time making the renewal of the cell much more convenient. The cost of electrical energy from these cells for some purposes would not be excessive, as, for instance, a 600-ampere hour renewal comprising all the perishable parts of the cell costs only $2.52, which is less than ½ cent per ampere hour. It is stated that this cell gives rise to no fumes, that the liquid does not corrode machinery, that there is no creeping of salt and that the cells do not freeze in ordinary cold weather. The pamphlet shows and describes also the Edison spark coil and gives a variety of useful data and information as to care and handling of batteries. As a whole, the publication is an admirable piece of work, well calculated for its purpose.

News of the Trade.

CHANGE OF ADDRESS.—The Manufacturers Agents' Association at Los Angeles, Cal., has taken larger quarters and its new address is 461 Pacific Electric Building.

H. M. BYLLESBY & COMPANY, the engineers and contractors, etc., announce the removal of their general offices in Chicago to the American Trust Building, Clark and Monroe Streets.

HOPPES MANUFACTURING COMPANY, of Springfield, O., maker of steam feed and exhaust purifiers, has established a branch of its business at 40 Dearborn Street, Chicago, in charge of Fishurck & Scudder.

MOTOR GENERATOR FOR WIRELESS TELEGRAPH.—The New York Navy Yard, Brooklyn, N. Y., has recently ordered from the Crocker-Wheeler Company, of Ampere, N. J., a motor-generator to be used in connection with its wireless telegraphic equipment.

EMILIO LATTES FRIAS & CO., 704 Casilla Correo, Buenos Ayres, South America, announce their readiness to conduct a commission and consignment business. The firm is duly registered with the Tribunal of Commerce and consists of Mr. Frias and Mr. Salvador A. Pratto.

CHANGE OF ADDRESS.—The new address of the India Rubber & Gutta Percha Insulating Company, makers of the famous Habirshaw wires and cables is the Postal Telegraph Building, 253 Broadway, New York City. Mr. J. B. Olson reports very large orders. The contract on the huge new Hall of Records has just been completed.

THE JOHNS-PRATT COMPANY, of Hartford, Conn., manufacturer of electric insulation and supplies, contemplates extensive additions to its plant. The plans call for a three-story manufacturing building, 48x132 feet; a factory building, 43x95 feet, four stories high, and a one-story addition, 26x35 feet. One of the present buildings will be carried up two additional stories.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, has recently established a department for illuminating engineering, and is now prepared to furnish plans for lighting factories, shops, offices, hotels, apartment houses, dwellings, etc. The company will be glad to furnish advice upon this subject on receipt of plans or drawings showing the construction and arrangement of the building to be illuminated.

THE STROMBERG-CARLSON TELEPHONE MFG. COMPANY, Rochester, N. Y., has closed contracts for switchboards for the following places: Exeter, Neb.; Portsmouth, N. H.; Bedford, Ind.; Hartford, Conn.; Rochester, N. Y. Also a 3,000-line multiple board for the People's Home Telephone Company, Morgantown, W. Va., and one for the Marietta Home Telephone Co., Marietta, Ohio.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 29, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 114 Nassau St., N. Y.]

820,931. FURNACE FOR BURNING COMMINUTED MATERIAL; Hosea K. Kriebel, Philadelphia, Pa. App. filed Dec. 29, 1904.

821,611. TROLLEY FOR ELECTRIC RAILWAYS; Edward F. Creevy, Chicago, Ill. App. filed July 11, 1900. The patentee makes use of round electric rods or wires stretched throughout the length of the conduit and has carriages with rollers to contact therewith in place of the usual shoe.

821,615. MAGNETIC SEPARATOR; Myron Dings, Milwaukee, Wis. App. filed Sept. 15, 1904. The pulverized ore is delivered upon the apex of a rotating cone and falls therefrom over a series of steps or terraces exposed to a magnetic field. The rotary displacement of the magnetic particles is greater than that of the non-magnetic particles, so that separation is effected.

821,623. STORAGE BATTERY FILLING APPARATUS; Thomas A. Edison, Llewellyn Park, N. J. App. filed Nov. 2, 1904.

821,624. GAS-SEPARATOR FOR STORAGE BATTERIES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Nov. 2, 1904.

821,625. PROCESS OF TREATING ALKALINE STORAGE BATTERIES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Nov. 5, 1904.

821,626. PROCESS OF MAKING METALLIC FILMS OR FLAKES; Thomas A. Edison, Llewellyn Park, N. J. App. filed Mar. 30, 1905.

821,628. PROCESS FOR MAKING CONDUCTING FILMS; Thomas A. Edison, Llewellyn Park, N. J. App. filed May 26, 1905.

821,639. FIREMAN'S SIGNALING SYSTEM; Alan J. Hart, Montreal, Canada. App. filed Dec. 12, 1904. The different sections of the hose have springs or conductors thereon which are automatically engaged with one another when the hose sections are coupled. In this way a signal circuit is completed from the engine to the location of the fireman.

821,655. RADIUM SURFACE; Hugo Lieber, New York, N. Y. App. filed July 30, 1904.

821,672. AUTOMATIC CONTROLLER FOR MOTOR COMPRESSORS. Walter J. Richards, Milwaukee, Wis. App. filed Mar. 9, 1904. Provides a constantly opposed shunt magnet operating a main switch for a motor compressor, such shunt magnet being directedly operated by a primary switch. Further provides means for inserting an external higher resistance in series with the shunt magnet when the main switch is closed.

821,673. SYSTEM OF FLUID PRESSURE CONTROL; Walter J. Richards, Milwaukee, Wis. App. filed Mar. 21, 1904. Has a continuously revolving electric motor and a magnetic clutch intermediate the motor and the air pump. The operation of the magnetic clutch is dependent on the air pressure in the reservoir.

821,697. ELECTRIC CURRENT CONTROLLER; Lynde Bradley, Milwaukee, Wis. App. filed June 9, 1904. Has a plurality of tubes filled with granular carbon on carbon wafers and plungers therefor arranged to compress the carbon so as to vary the resistance thereof. Means are provided by which the operating handle moves with a uniform pressure at all the different stages of compression of the carbon.

821,719. TROLLEY; Minas H. Kashian, Amesbury, Mass. App. filed Sept. 26, 1904. In order to avoid the expense of frequently renewing trolley wheels the patentee provides a structure in which the tread is removable and in which the axle is journalled in special lubricating boxes.

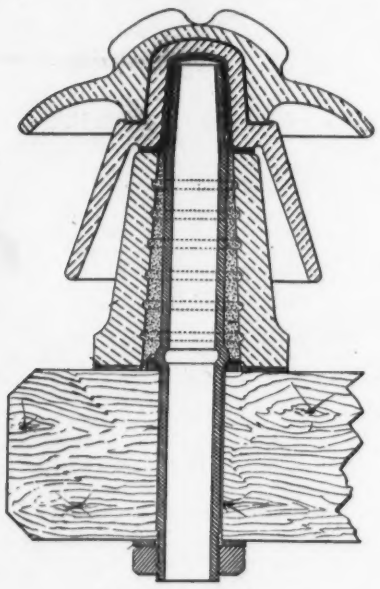
821,741. TELEGRAPHY; Michael I. Pupin, New York, N. Y. App. filed Jan. 28, 1895.

821,746. INSULATOR; Augusto Richard, Milan, Italy. App. filed Mar. 17, 1904. The insulator has a metallic post which is surrounded by a cylindrical porcelain block and which serves as a firm support for the insulator proper. The insulator is supported from the block by a washer to prevent breakage.

821,747. CONTROLLING APPARATUS; Walter J. Richards, Milwaukee, Wis. App. filed July 2, 1903. In order to take the load off of an air compression motor when it is first starting up, the patentee provides special valves in the compression cylinder which are magnetically opened until the motor arrives at its proper working speed.

821,753. PORTABLE TELEPHONE; Will A. Shimer, Rochester, N. Y. App. filed Oct. 3, 1905.

821,767. RAILWAY SIGNALING SYSTEM; Louis H. Thullen, Edgewood Park, Pa. App. filed Jan. 12, 1906. The motors for working the signals are operated by a three-wire polyphase system the circuits of which are closed by relays operated by short circuiting the track rails. The latter are normally maintained at a direct current difference of potential.



821,746.—Insulator.

821,768. CONTROLLER REGULATOR; Joseph V. E. Titus, Keokuk, Iowa. App. filed Apr. 11, 1904. A device for use with that style of controllers in which rapid movements of the controller arm are prevented. In case the trolley leaves the wire, a magnetic device permits rapid motion of the controller arm, so that the motors may be quickly put in parallel to exert a magnetic braking effect.

821,800. LOCK-OUT DEVICE FOR TELEPHONES; Ruben C. M. Hastings and Thurston Matheny, Athens, O. App. filed Apr. 4, 1905.

821,801. ELECTRIC RAILROAD SIGNALING DEVICE; Henry A. Hoeschen, Omaha, Neb. App. filed May 2, 1903. A form of tappet adjacent to the track rails which transmits a signal when depressed by the car wheels. Has a finger which is rocked so as to operate a current generator by a movement of the train in one direction, but not in the other.

821,807. MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES; Milo G. Kellogg, Chicago, Ill. App. filed Nov. 30, 1898.

821,820. SELECT RINGING AND LOCKING DEVICE; Orris H. Newman, Pekin, Ill. App. filed Apr. 3, 1905.

821,830. METALLURGICAL FURNACE; Isaiah L. Roberts, New York, N. Y. App. filed May 31, 1904.

821,832. ELECTRICAL DISCHARGE APPARATUS; James E. Seeley, Los Angeles, Cal. App. filed Jan. 25, 1905.

821,835. RAILWAY SIGNAL; William A. D. Short, Lexington, Ky. App. filed Sept. 14, 1905. Mechanical details of a semaphore signal employing an oil lamp, and a shutter with a small magnet operated windlass for raising the same.

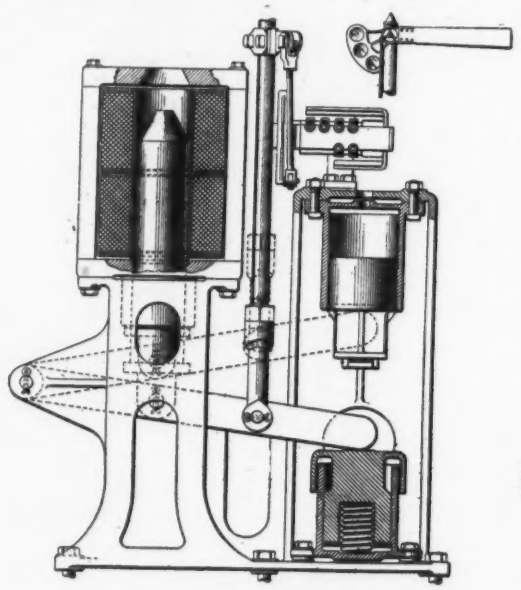
821,837. DYNAMO-ELECTRIC APPARATUS; William Stanley, Great Barrington, Mass. App. filed May 25, 1905.

821,877. MUFFLER FOR TELEPHONE TRANSMITTERS; George A. Long, Hartford, Conn. App. filed Mar. 1, 1904.

821,898. CENTRAL-ENERGY TELEPHONE SYSTEM; William A. Taylor, Chicago, Ill. App. filed Feb. 4, 1901.

821,899. RAILWAY SIGNAL OPERATING MECHANISM; Louis H. Thullen, Edgewood Park, Pa. App. filed Mar. 24, 1906. An electrically operated semaphore having a power solenoid or magnet and an armature which moves against pneumatic buffers at the respective limits of its throw.

821,902. STATIC INDUCTION GENERATOR; Henry B. Todd, Meriden, Conn. App. filed Feb. 18, 1905. A generating plate or cylinder for induction machines composed of a body of fibrous material saturated with sulphur by immersion in a melted bath.



821,899.—Railway Signal Operating Mechanisms.

821,909. APPARATUS FOR THE REGULATION OF ELECTRIC SYSTEMS; George A. Wells, Jr., New York, N. Y. App. filed Nov. 10, 1903. Employs a dynamo electric machine with a heavy fly wheel in combination with a booster to increase its sensitiveness. This compensating machine is designed to run as a motor, but when the supply of electric power diminishes, the fly wheel causes it to act as a generator to deliver additional current.

821,914. AUTOMATIC ELECTRIC SIGNALING DEVICE FOR RAILWAY SWITCH SYSTEMS; David C. Wolfe, Lyons, Kan. App. filed Aug. 9, 1905. A special trolley is laid adjacent the usual track rail and an arm depending from the locomotive cab makes contact therewith and completes a signal circuit in the engine.

821,916. RAILWAY SIGNALING SYSTEM; Azel Ames, Jr., Cleveland, O., and John S. Hobson, Edgewood Park, Pa. App. filed Feb. 24, 1906. Details of circuits for an overlap railroad signal system employing track rails energized to direct current difference of potential and polarized relays to give the overlap feature.

821,920. INSULATING APPLIANCE; William A. Bonnell, Brooklyn, N. Y. App. filed Apr. 3, 1905. A form of outlet box for conduit wiring designed to give efficient insulation.

821,923. RAILROAD SIGNAL; Walter C. Burton, Fitchburg, Mass. App. filed Sept. 30, 1905. A box adjacent the track rails has a magazine of torpedoes and an electro-magnetic feeder impels the torpedoes in the path of a plunger depressed by the train whenever desired.

821,936. CURRENT REGULATOR; William K. Gibboney, Buffalo, N. Y. App. filed Nov. 19, 1904.

821,948. ANTISEPTIC TELEPHONE-MOUTHPIECE ATTACHMENT; George W. Merritt, San Francisco, Cal. App. filed Mar. 28, 1905.

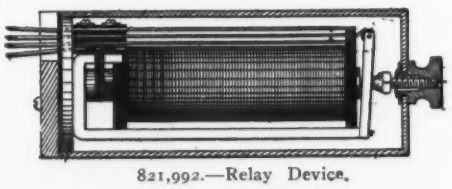
821,981. TELEPHONE SWITCH; Addington L. Brinckle, Philadelphia, Pa. App. filed Dec. 13, 1904.

821,992. RELAY DEVICE; John P. Downs, Cleveland, O. App. filed May 1, 1902. A telephone relay having a freely movable armature carrying a roller for displacing the contact making springs of the relay, which lie parallel with the core for this purpose.

822,928. RAILWAY SIGNALING SYSTEM; Jacob B. Struble, New York, N. Y. App. filed July 13, 1904. Employs batteries for the motor signal which are of high e.m.f. and has means for opposing a counter e.m.f. to such batteries for the energization of the track rails, whereby the latter are maintained at a low potential difference.

822,036. ELECTRICAL SWITCH; Earl C. Bacon, Indianapolis, Ind. App. filed Dec. 8, 1904. Mechanical details of a switch for directing the current from one set of lamps into another automatically at periodic intervals. It is operated by the expansion of a toggle or link connection under the influence of the current.

822,043. AUTOMATIC INSULATORS; Gaetan M. Corell, New York, N. Y. App. filed Dec. 21, 1904. The line wires are stretched between specially constructed insulators having spring pressed plungers which are normally tensioned apart by the wires. In case the wire breaks the plungers approach one another and complete a new path for the current.



821,992.—Relay Device.

822,084. ELECTRIC CIRCUIT BREAKER; George G. Stout, Parkersburg, W. Va. App. filed Mar. 30, 1905. A magnetic cut-out or circuit breaker having a balance lever which is displaced by excessive current in a solenoid. The displacement closes a local circuit through a magnet which opens the switch.

822,095. LIFTING MAGNET; Charles E. F. Ahlm, Cleveland, O. App. filed Aug. 28, 1905. A form of lifting magnet having a pair of concentric annular grooves in which magnet wire coils are placed and which are connected so as to produce three poles in concentric rings adjacent to the coils.

822,109. ELECTROLYTIC CELL; George A. Gabriel, New York, N. Y. App. filed Feb. 26, 1906.

822,167. BED WARMER OR COOLER; Charles C. Vaughn, San Francisco, Cal. App. filed June 19, 1905. A bell-shaped receptacle or basket has a lamp receptacle to receive an ordinary incandescent lamp, or a small fan motor for warming or cooling purposes, respectively.

822,168. CHANNEL PIN; Eugene W. Vogel, Chicago, Ill. App. filed July 27, 1905. A device for connecting bonds to rails comprising a copper pin of crescent-shaped section which is driven through the rail around the bond.

822,175. PROCESS OF LOCATING AND EXTRACTING METALS BENEATH THE EARTH'S SURFACE; Edson R. Wolcott, Golden, Cal. App. filed Sept. 5, 1905.

822,193. RELAY DEVICE; John P. Downs, Boston, Mass. App. filed Oct. 14, 1904. A telephone relay having an electrio-magnet with a protective shell or casing, and a thumb nut permanently secured to said shell and adapted to secure the same removably in position over the parts of the relay.

822,211. INSULATOR; Fred M. Locke, Victor, N. Y. App. filed June 23, 1902. In order to provide an increased arcing distance for an insulator, the patentee provides the usual saddle with a petticoat supported at the apex of a very large vitreous conical block.

822,223. AUTOMATIC CONTROLLER FOR PRESSURE SYSTEMS; Walter J. Richards, Milwaukee, Wis. App. filed Apr. 6, 1905. In order to secure the starting of the apparatus by the pressure in the air reservoir, the patentee provides a solenoid having a pair of coils respectively in shunt and series with the motor, and which are specially connected in circuit with the pressure gauge.

12,490. CONTROLLING MEANS FOR ELECTRIC CIRCUITS; Julius K. Lux, St. Louis, Mo. App. filed Apr. 5, 1906. Details of a snap switch having a cylindrical casing with a button projecting from its upper face and having spring and cam means for imparting an abrupt movement to the switch blades therefrom.

Atlantic City Convention of National Electric Light Association.

THE twenty-ninth convention of the National Electric Light Association was held at Atlantic City, N. J., June 5, 6, 7 and 8, with headquarters on Young's Pier, and with very full occupancy of thirty-five or forty good, bad and indifferent hotels that help to make the famous resort so unique in its capacity to take care of pleasure seekers. The Association was favored throughout the week with weather almost ideal, and, owing to the care and thought with which the preparations had been made, the results were in every respect brilliantly successful. The attendance was also very large, possibly constituting a record in this respect before the week closed. Owing to the attractions of the place, a very large number of delegates gathered at the seashore long before the convention opened, as many as 250 spending a cool and delightful Sunday within earshot of the booming surf. By the end of the first day a round thousand had registered, and right up to the close of the meeting visitors were still arriving by fifties and donning the numbered badges of the Association. This year the body itself undertook the responsibility of issuing the bulletin, giving the registration, with full names and addresses of each person in attendance, and, in spite of the difficulties of carrying out this work, several daily issues were made of this invaluable guide.

The quality of the attendance was extraordinarily high, and almost perhaps for the first time in the history of the Association the color of the badge denoting active membership appeared to predominate over all the other hues of the rainbow that have been appropriated for the purpose of designating the grades and degrees in the Association. It was a great source of gratification also to those who have labored for years past to promote the welfare and influence of the Association to note that at this meeting for the first time in its history it could declare a membership exceeding 1,000, while the interest shown, and the numerous accessions during the week went far to encourage the hope, not altogether vain, that the coming year might see at least 500 more enrolled, with the possibility of 2,000 not far away. The fact that the industry itself is growing at the rate of 500 to 600 new local companies a year is warrant for the aggressive missionary work that the officers have been doing to secure new members. It is doubtless due to the fact that the active members were out in such force that the regular sessions were so largely attended. Although the hall reserved for the meetings was large, the hundreds of seats which were provided were at all times in full use, while now and again there was actually some difficulty in taking care of everybody. Such veterans as Messrs. Huntley and DeCamp, who have filled the presidential chair or other offices in bygone years, assured Mr. Blood that none of his predecessors had ever confronted and addressed a more earnest, influential and representative body of men, justified by their discussions and their experience to speak for the great art of electric lighting and power.

As noted above, none of the hotels were made headquarters, although the Marlborough-Blenheim answered this definition fairly well. But all the interest all the time centered at Young's Pier, which had been leased by the Association for the week with special privileges, but not excluding the public, which, on the contrary, was warmly invited and encouraged to participate actively in all that was going on. Thus the splendid exhibition of electrical apparatus made by some three or four-score of manufacturers was not only studied critically by electrical men themselves, but was the source of a great deal of instruction and amusement to the thousands of visitors drawn by idle curiosity or with the object of learning something new about this mysterious and universal agent, electricity. Note is made elsewhere of miscellaneous exhibition features in connection with the specific reference to the show itself, but it may be mentioned in passing that after this demonstration of what can be done under the fostering care of the Association, the manufacturers are likely themselves to take the matter up in succeeding years, as has been done in the street railway field; and this suggestion was indeed thrown out by President Blood in his annual address.

Supplementing the general exhibit made by manufacturers and supply houses of apparatus and material, was the remarkably fine display of central station advertising pictures by about fifteen of the leading companies. This exhibit was so suggestive and full of meat it deserved the study of many days, and will be made the subject of a special article in these pages by an expert. Some of the companies sent handsome original paintings, wash drawings and designs, representing in the aggregate a value of many thousands of dollars, and when framed and mounted, constituting a veritable art gallery, these caught the fancy of the public and formed a continuous center of interest. Supplementing this pictorial work were numerous examples of newspaper advertising, dodgers, folders, follow-up letters and other incidentals to the propaganda for electric current. These were all displayed on the walls and were the subject of close study by the central station men. In addition to this, several of the companies furnished large editions of their regular bulletins and of special pamphlets, which were given away to the public in literally thousands of copies, and were eagerly seized upon. In view of the respectable and well-to-do character of the public attendance, it is unquestioned that in this manner the seed was sown of a great deal of new business for the central stations in the towns and cities where these people live, so that many an inquiry can be traced back in the future to the show on Young's Pier.

From the fact that the Association had leased the pier for the week there was regularly provided abundant amusement for those not frequenting the business sessions, and, as a great many ladies were in attendance, this part of the programme worked out very happily. The exhibition hall was occupied by a first-class band, giving three concerts daily, and immediately in the rear of this was a large vaudeville theatre of such magnitude and pretensions that the "divine" Sarah Bernhardt gave a crowded performance there on Wednesday evening. Immediately beyond the theatre was a large hall devoted to the business meetings of the Association. Farther down the pier, which is a thousand feet in length, was a large skating rink, flanked by a deep sea net, hauling up large collections of fish twice daily from the ocean. At the extreme end of the pier was a De Forest wireless telegraph station in active operation, receiving and sending messages with a sending radius of about 150 miles. To many of the active members this last feature was quite new, while the other exhibits by their variety provided plenty of occupation all day long for the more idle, even if there had not been miles of boardwalk and the countless rolling chairs with which to wile the hours away. It had been feared by some of the officers that the attractions of Atlantic City might prove unfavorable distractions for the membership, but it was soon found on the contrary, that amusement was relegated by the central station managers to the evening hours, except when the absence of an afternoon session gave them a little larger leisure.

In addition to the regular business, of which record is made below, there were a number of features of entertainment specially provided by the Association itself, and on Monday evening a function was made of the opening of the electrical exhibition, when President Blood made a brief and pithy address declaring it ready. On Tuesday afternoon and successive afternoons the New York Edison Company served 5 o'clock tea near the meeting hall on the open pier, employing the electrical apparatus of heating companies represented amongst the exhibitors. This proved a very popular feature. On Tuesday evening the great new ballroom of the Marlborough-Blenheim was christened by

the Association with a reception and dance, when special music was provided for the dances, while the orchestra of the hotel played between whiles. Refreshments were also served and some 500 or 600 people—most of the ladies in full toilette—enjoyed the animated spectacle and gave themselves up enthusiastically to the exercises of the occasion. On Wednesday a sailing party from the inlet included a large number of delegates and ladies, and in the evening the Association gave a theatre party for "My Partner" at the Savoy, while many of the members were seen at the Bernhardt performance. On Thursday morning horseback rides for the children of the Association were furnished—a feature by no means the least popular amongst the entertainments. Thursday afternoon was devoted to a baseball game and to the golfing contest for the Presidential Cups at the Country Club. The provisions for Friday included a complimentary automobile trip for the ladies and a colossal "chair ride" on the boardwalk, everybody in attendance making it their conscientious duty to prepare for a place in the interminable line of rolling chairs. This amusing spectacle was to be photographed, as were the members in a group at midday on Wednesday. A special part of the programme coming rather in the regular order of business than as an amusement was the lecture delivered by Mr. E. W. Burdett on the "Meaning and Proper Treatment of the Agitation for Municipal Ownership," Mr. Burdett having made a recent trip to Europe for the special study of this problem.

It is only fair, in speaking of the enormous success of this convention, to emphasize the good work done by different individuals, first and foremost being Mr. Arthur Williams, chairman of the Convention Committee, who by his frequent visits to Atlantic City and careful forethought as to every detail, had literally guaranteed that there should be no failure in any respect. Through the liberality of the New York Edison Company in furnishing its employees, the Association was able to carry out with smoothness all the work of registration and the issuance of bulletins, thus relieving the staff under Miss Billings of a great deal of this work, which at such times proves peculiarly onerous. The preparatory work done by Secretary Eglin and by Miss Billings, assistant secretary, as to papers and programme was even more effective than usual, so that all papers were ready and available and could be readily secured by the members for consultation. The large attendance may be attributed in considerable measure to the indefatigable efforts of Mr. George F. Porter, master of transportation, seconded by Mr. Hodskinson in Boston, and Mr. Perry in Chicago, their special trains and special cars running through in all comfort and on schedule. A great deal of heavy convention work was also carried out by Messrs. Dudley Farrand, J. I. Ayer, Paul Lupke and M. W. Byers. It would, however, be impossible to mention all who by thought and effort contributed to the grand total of success.

The opening session of the convention was called to order at 10.20 A. M. on Tuesday by President Blood, and after a few appropriate remarks, Mayor S. P. Stoy, of Atlantic City, was introduced and delivered an address of welcome. This was immediately followed by President Blood's address, which will be found on page 1176. The following committee was appointed to consider the suggestions in the president's address: Messrs. Samuel Scovil, of Cleveland, Arthur Williams and T. Commerford Martin, of New York. At the session of Tuesday a special committee was authorized to report on street lighting specifications before the close of the convention if possible, or if not to report next year. This committee will take up questions that will come up in connection with contracts for new forms of street lamps.

At an executive session on Wednesday the following nominating committee was appointed: Messrs. Samuel Scovil, of Cleveland; James I. Ayer, of Boston; J. E. Montague, of Niagara Falls; J. T. Cowling, of Mt. Vernon, N. Y., and Percy I. Ingalls, of Newark, N. Y. A committee to revise the constitution and by-laws was appointed, consisting of Messrs. Samuel Scovil, L. A. Ferguson and W. C. L. Eglin. An amendment to the Constitution was proposed to provide for an invited membership class to be composed of college professors. The amendment was referred to a committee consisting of Messrs. Dudley Farrand, Arthur Williams and W. C. L. Eglin.

On Thursday morning the committee having in charge the judgment of papers offered in competition for prizes aggregating $1,000 for the best paper on the subject of "Organization and Conduct of a New Business-Getting Department in Cities of Less than 50,000 Inhabitants," reported that 22 papers had been submitted, and that its members were unanimous in awarding the prizes as follows:

First prize to Mr. M. S. Seelman, Jr., of the Brooklyn Edison Company; second prize to S. M. Kennedy, of the Edison Electric Company, of Los Angeles; third prize to J. M. Robb, of the Peoria Gas & Electric Company. In addition to these prizes the committee made honorable mention of the papers of C. M. Jackson, of Toledo; F. D. Sampson, of Charlotte, N. C.; W. R. Sweany, of Minneapolis, and James Wiltse, of Brooklyn. The chair called upon Mr. J. Robert Crouse, of the Cooperative Electrical Development Association, who originated the idea of this prize contest, to come forward and award the prizes. Mr. Crouse explained that his Association had in mind offering other prizes along this line, and that this was only a begining. These prizes were given through the National Electric Light Association in order to give the matter standing.

At this session a committee was appointed on relationships between the National Electric Light Association and various State and local organizations of a similar character, consisting of Messrs. S. R. Bradley, Jr., New York; E. H. Davis, Pennsylvania; L. H. Scherck, Alabama; John F. Gilchrist, Illinois, and W. H. Fellows, Kansas.

Following are abstracts of the papers presented at the convention, and of the discussions up to noon on Thursday, June 7:

REPORT ON PROGRESS.

The report of the committee on progress, Mr. T. C. Martin, was a document of 42 pages and dealt with conditions in the art and industry under 17 heads. It pointed out the fact that there had been an electrical renaissance since the end of 1904, as evidenced by the figures of growth and the number of new central station enterprises. The gaze of the manager is no longer turned exclusively inward, on his plant, but, more largely, outward, on his customer. Hence there had been a marked commercial development. The current issue of the authoritative *Central Station List* for the first quarter of 1906 contains the names of 4,839 plants, of which 3,732 were under private and corporate management and 1,107 were municipal. The gain in six months had been 301 plants, or 600 for the year, a very close proof of the maintenance of a steady and high rate of increase. While of these new plants in the first half of 1905-6 no fewer than 48 were in Texas, the older States were notably leaders in activity, Pennsylvania accounting for 21 and New York for 18, Ohio and Michigan for 15 each. An increase of 15 per cent over 1904 would bring the investment in distinctive central-station plants up to $700,000,000 in 1905. The gross earnings were estimated at $135,000,000, expenses on which at 70 per cent would amount to $94,500,000. As a matter of fact, the output of electricity was everywhere much larger than ever before, but the rates obtained were frequently much lower than ever before.

The report included also some new statistics on electric light and power apparatus based on the returns not yet issued by the U. S. Census Office of electrical manufacturing in 1904. The total output of all strictly electrical apparatus for that year was valued, at the factories making it, at $157,949,514. Specific items were as follows: 15,130 dynamos of 1,328,243 hp, value $11,084,234, and $1,740,534 of dynamotors, motor-generators, and so forth; transformers worth $4,468,567; 79,877 motors of all kinds of 678,910 hp, worth $22,370,626; storage batteries worth $1,977,435; lighting carbons worth $1,050,971; arc lamps to the number of 194,757, worth $1,574,422; incandescent lamps and parts worth $8,964,065, of which lamps over 83,000,000 were of 16-cp; electric light fixtures worth $3,294,606; insulated wires and cables worth $34,519,699; electric conduits worth $2,416,245; rheostats and resistances valued at $1,328,752; measuring instruments valued at $5,004,763.

The dynamos reported while worth only $600,000 more than those of 1900, were nearly 600,000 hp greater in capacity, showing how the increase in size of unit had lowered cost. As to

arc lamps, only 1,748 of those made were of the open-arc type; whereas in 1900 the production, even then dwindling, was 23,656. The effect of sign lighting was indicated by a five-fold increase, in the semi-decade, in the number of miniature and decorative lamps.

The report included a large amount of comparative data as to development in France, Germany and England; and then dealt with new central station work in America, emphasizing the use of the steam turbine and the huge gas engine. After discussing wiring rules, and the joint operation of pole lines, the report took up the old and new illuminants now dominating the field by their performance or their prominence, touching with particularity on metal filament incandescents and impregnated carbon arcs of the "flaming" type. With regard to all these, specific figures were given, as well as on Nernst and vacuum tube lamps. The closing portion of the report dealt with meters and rates; questions of insurance; accident swindles, state lighting commissions, and the proposed international standardization of currents and apparatus, to be discussed in London this month.

THE MERCURY ARC RECTIFIER FOR STREET ILLUMINATION.

Mr. W. S. Barstow presented a paper at the Atlantic City Convention of the National Electric Light Association in which he gave an interesting account of experience with the mercury arc rectifier system used in the operation of "magnetite" lamps for street illumination. There has, he said, during the last two years, been in course of development a new system (if it may be so called) for outdoor street arc lighting, which not only promises to take an important place in the history of the art, but in many instances to replace the carbon arc. It is actually the first successful effort to increase commercially the efficiency of outdoor arc illumination, while at the same time it opens up new fields where the present type lamps cannot be used. The magnetite mercury arc rectifier system requires not only 35 per cent less energy at the lamp than any existing system for the same illumination, but makes it possible to do outdoor street arc lighting from transmission systems of 35 cycles and under without the use of motor-generator sets or other moving apparatus. In the city of Portland, Ore., about two years ago this system was installed on a small experimental scale. The street lighting system at that time had been in successful operation for many years and was of the old-style open-arc type, supplied with direct current.

In the very early days current supplied to Portland was generated by water power at Oregon City, about seventeen miles south of Portland, and was transmitted to Portland for arc and incandescent lighting. As all arc lighting was done on the high-tension system and incandescent lighting on the high-frequency, single-phase system, each machine had a separate set of feeders from Oregon City to Portland. (This was one of the first instances where, previous to 1892, single-phase, high-frequency machines were operated at a direct pressure of over 4,000 volts.) The business increased so rapidly that in 1891 there was transmitted in actual commercial capacity energy for 7,200 incandescent and 650 arc lamps by means of the systems above mentioned. As business grew and electric railways were installed in Portland, a second power plant was built at Oregon City, and a 33-cycle, three-phase, 5,000-volt system installed, with direct-connected vertical wheels, especially arranged for a head varying from 15 to 45 ft., and current was transmitted from there by rearranging the original arc and incandescent circuits, each generator being connected to a single three-conductor, three-phase feeder. To each feeder in Portland were connected a set of statics and a rotary transformer, so that there were practically a number of independent generating and transforming plants. To provide for the city lighting motor-generator sets were installed in Portland, each set consisting of a direct-current motor directly connected to two direct-current arc machines. Thus, in these early days several transformations were necessary before the alternating current delivered to the sub-station was finally distributed to the system, and it required 806 watts per lamp of the transmitted energy in the form of 33 cycles, 5,000 volts, three-phase, to supply each 500-watt lamp installed in the city. In remodeling the system, as no arc lighting could be taken from the transmission frequency of 33 cycles, it was either a case of using alternating-current, high-tension motor-generator sets, changing the frequency from 33 to 60 cycles, or a high-tension motor directly connected to direct-current arc machines. Under these conditions, and with the original idea of reducing motor-generator capacity and the investment in generating system, several magnetite lamps were installed as an experiment about two years and a half ago, and from that time to the present modifications and improvements were made until now the lamps are equal in all respects to any arc lamp of either alternating or direct-current system. In the meantime lengthy experiments were made with the mercury arc rectifier. About one year ago the results appeared so promising and so much progress had been made in such a short period that an order was placed to install the entire system of over 1,200 lamps in Portland with mercury arc rectifiers and magnetite lamps. There have now been in operation in Portland for several months over 800 lamps with rectifiers, and the installation is being rapidly increased as fast as deliveries can be made. The system has proved successful and has fulfilled expectations. Considerable difficulty in the form of static discharges and short life was at first experienced with the tubes. The tubes, which were of small size, were subjected to very rigid requirements on account of the alternating-current pressure of 18,000 volts, a pressure which was very much higher than anything yet attempted with mercury arc rectifiers. The tubes have now averaged over 650 hours and several have exceeded 730 hours, 500 hours being the economical requirement, and anything above this being in the nature of a gain in the original calculated efficiency of the system.

A simple description of the system as installed is as follows: The transmitted energy in the form of 10,000-volt, three-phase, 33-cycle current enters constant-current transformers, each transformer being of single-phase design, the primary of which is wound for 10,000 volts and the secondary for 16,000 volts. In the secondary is a center connection for the rectifier. The mercury arc rectifier is mounted upon a switchboard panel directly above the oil switch. It is excited by a small amount of 115-volt alternating-current energy. This is sufficient to start the rectifier after the same has been moved slightly with a handle for that purpose in order to establish the mercury arc. It requires but a few seconds to start up a circuit, and, when once started, it is not necessary to maintain the exciting circuit in operation, although this has been the practice up to the present time. In each side of the alternating current of the transformer is placed a reactance and another in the direct-current side. The lamps themselves require four amperes at an average of about 80 volts, or 320 watts, and give an equal illumination to the old-type open lamp requiring 500 watts. As the original distributing system was installed for 10-amp. lamps, losses in these conductors have of course been reduced to a minimum. The present lamps are installed in units of 75 lights. An extra transformer panel with rectifier is provided, so that in the case of any accident happening to the transformer or rectifier the circuit can immediately be plugged in on the spare set. The lamps themselves are, no doubt, familiar to many, having been described in some of the technical papers.

The efficiency of the rotary transformer motor-generator system, as originally installed in Portland to take care of the street arc lighting, from the alternating-current transmitted energy to the direct-current energy distributed to the lamps, was 62 per cent at or near full load (which is the prevailing condition).

The efficiency of the constant-current transformer mercury arc rectifier system from the alternating-current transmitted energy to the direct-current energy distributed to the lamps is at full load 88 per cent (at 10 per cent overload, 89 per cent); at three-quarter load, 85 per cent; at half load, 81 per cent, and at one-quarter load, 80 per cent. This efficiency was obtained by measuring the true watt input of the primary alternating-current energy and the true watt output in direct current, and includes all transformers and reactances, but not the small fan motor used to cool the rectifier tube.

Having thus effected a saving of 26 per cent in the efficiency of the transforming system itself in Portland, the company secured further economy by the use of magnetite lamps, using 320 watts in the lamp in place of the 500 watts, thus obtaining for 364 watts of transmitted energy the same illumination that originally required 806 watts, or a saving of 1,768 kw-hours per lamp per year; or on the total Portland installation a saving in

capacity of 531 kw, and a saving in total energy of 2,121,600 kw-hours per year.

The efficiency of a standard motor-generator set using a high-voltage motor and direct-current arc generator is about 76 per cent, so that if a modern installation where low-frequency alternating current is transformed by synchronous motor arc machines into direct-current energy for the present type of 500-watt arc lamps, there should be installed the constant-current transformer mercury arc rectifier system with magnetite lamps, the gain in efficiency for the same illumination would amount to 294 watts per lamp, or 1,176 kw-hours per lamp per year.

The high commercial efficiency of the latter system is due to a very large extent to the simplicity and economy of the rectifier tube itself. A tube of a capacity of about 30 kw has a constant loss of but 25 volts, or, at four amperes, 100 watts per hour, while the cost of renewing the tube on the basis of 500 hours' life about equals the cost of labor and renewals on a motor-generator set.

Owing to the fact that both parts of the alternating-current waves are used, the voltage of the alternating current leaving the transformers to the rectifier tube to produce a desired voltage in distributed direct current must be about three times the desired direct-current voltage required by the lamps in circuit. Thus, about 18,000 volts on the secondary of the transformer tubes gives a useful direct-current voltage of about 6,000.

In the use of the magnetite system a commercial question arises which, after very careful consideration, should be definitely answered before the system is adopted to any great extent. I refer to the specifications used in the present public lighting contracts. About fifteen years ago considerable thought was given to the subject by this association, resulting in a campaign of public education which produced the proper result at that time of rating street arc lamps by the "watts in the arc" and dropping out of contracts the terms "normal candle-power." If the price of public lighting is to be fixed by "watts in the arc" on the same basis as present cost, the public will profit by this lamp (due to lamp efficiency) to the extent of 36 per cent, the company gaining in transformer efficiency to an extent of 17 per cent.

The question as to how the public and the companies should share this gain so as to determine under what specifications the illumination should be furnished is a broad one and is a matter that should be carefully considered at this time, so that the introduction of this new system shall be accompanied by a proper standard form of specifications.

DISCUSSION.

Mr. Barstow, answering a question at the close of the paper, said that the investment for rectifiers was about the same as it would be for a motor-generator set for supplying ordinary arc lamps for the existing supply at Portland.

Mr. P. D. Wagoner, of Schenectady, explained that the tubes at present cost $25 each, with a rebate of $5 each for the burned-out tubes when returned. He then spoke of the method of arranging city contracts for lighting when changes were made from existing direct-current arc lamps to the magnetite arc. In one case the company contracted to furnish a lamp giving equal illumination to the ordinary 500-watt open arc lamp. In another case the contract was based on luminometer tests, and the lamps were specified to be such that a certain size of type in a General Electric luminometer could be read midway between lamps a certain number of feet from the lamp. In another case the contract specified that the new lamps should give as good light as lamps already in use on the company's circuits. He called attention to the fact that distribution of light from a flaming arc lamp is better for street lighting than the light from the ordinary direct-current carbon arc, which gives most of its light from a crater. In other words, a greater proportion of its total illumination is given at angles a little below the horizontal, which is a distribution desirable for street lighting, even if the main spherical candlepower is the same in both cases.

Mr. Arthur Williams, of New York, thought that it might be well to have a committee appointed to consider specifications for street lighting, covering the use of the various new illuminants which had come into the field, so that the benefits of increased efficiency might be obtained partly by the central station and partly to the public.

Mr. Barstow, in response to questions as to the performance of the magnetite arc lamp at Portland, said that at first the lamps acted badly. There were many outages. The trouble was found to be in the magnetite sticks. A button of hard glazed slag would form on the end of the stick, this button being an effective insulator. The magnetite electrode is made by packing magnetite into an iron sheath or cylinder. This at first had been done at the factory by hand, with the result that the packing was uneven, and when packed too hard the slag would form. Since machine packing had been adopted at the factory much less trouble had been experienced. In fact, this trouble had been continuously growing less as the process of manufacture was perfected and more electrodes were being turned out. The cost of attendance on these lamps was a little less than on the old direct-current open arcs, which were displaced. In response to a question as to how the change had been accomplished in Portland from a legal aspect, Mr. Barstow said that the method of the proceeding had been to obtain a release from the city engineer stating the illumination furnished by the magnetite arc lamp to be as good as that supplied from the old open arcs.

Mr. C. A. S. Howlett, of Chicago, asked how the efficiency of an alternating-current generator, step-up transformer and rectifier, as installed for the magnetite lamps at Portland, compared with the direct-current arc dynamo.

Mr. Barstow said that the efficiency was about 4 per cent in favor of the rectifier outfit, being about 82 per cent as against 78 per cent for the direct-current arc machine.

FLAMING CARBON ARC LAMPS.

Mr. L. B. Marks, in a paper with the above title, gave much valuable information concerning the relative costs of operating enclosed arc lamps and flaming arc lamps. It was shown that on account of the disadvantageous distribution of the illumination from the flaming arc lamp for street lighting, one lamp of this type cannot replace more than two enclosed arc lamps, each consuming the same amount of power as the flaming arc, which gives five times the total illumination of each of the other lamps. The cost of carbons and maintenance of the two enclosed arc lamps for a year of 4,000 hours, would be $8.50, while the equivalent costs for one flaming arc lamp would be $46.51. When the station costs of producing energy is less than two cents per kw-hour, and the price of flaming arc carbons is 10 cents per trim, it would not pay to install the flaming arc even if the extra cost of new lamps be left out of consideration. When the cost of energy is high, however, the flaming arc lamp makes a more favorable showing, particularly if the cost of carbons is reduced. For instance, at a station cost of 2.75 cents per kw-hour for energy, the cost of operation of two 500-watt enclosed arc lamps is $118.50 per year, against $101.50 per year for one 500-watt flaming arc lamp with carbons at 10 cents per pair, and against $83.26 with carbons at 5 cents per pair.

In the operation of a commercial outdoor circuit, with lamps burning on an average approximately three hours a day, or 1,000 hours a year, equipped with the present type of flaming arc lamps, compared with the operation of a similar circuit equipped with enclosed arcs, even waiving the additional cost of new lamp and installation, it would not pay from the standpoint of illumination to substitute the flaming arc for existing enclosed arcs unless the flaming arc lamps replace at least three enclosed arcs. Neither would it pay in the above case, with carbons at 10 cents per trim, the relative cost of operating the lamps here being $16.97 and $7.45. But with flaming carbons at 5 cents a trim, the relative costs of operation being $12.82 and $7.45, the substitution would pay if the flaming arc replaces at least two enclosed arcs. If the cost of flaming arc carbons were reduced to the present cost of enclosed arc carbons (2.75 cents per trim) the relative costs of operation would be $10.95 and $7.45, and in this case still it would not pay to make the substitution unless at least two enclosed arcs are replaced by one flaming arc.

The author derived the following conclusions:

First, that the flaming carbon arc lamp of commerce produces five times the total luminous flux of the enclosed arc lamp for the same expenditure of electrical power in the arc.

Second, the lamp is well adapted for purposes of illumination where a flood of light is desirable in a single unit, as, for instance, for advertising purposes.

Third, the lamp may be used economically in the lighting of some large interiors, and in large open spaces, such as public squares and wide boulevards, if the lamps are placed at a considerable height, say, 40 to 50 ft. above the ground.

Fourth, the concentration of such a large flux of light in a single unit renders the lamp unsuitable for purposes of ordinary street illumination in the United States.

Fifth, the advantage of economical production of light is offset by reason of the frequent trimmings with expensive carbons.

Sixth, the fumes and ash given out by the lamp, the unsteadiness of the light, and the objection to frequent trimming, render it unsuitable for most cases of interior illumination.

DISCUSSION.

Mr. P. D. Wagoner said that the cost of electrodes for the magnetite arc lamp is only one-fortieth of the figure given by Mr. Marks for electrodes, costing 15 cents per trim. (Mr. Marks gave this as the present cost of flaming arc lamp electrodes in this country.)

Mr. Hallberg, referring again to the magnetite arc lamp, said that in Mr. Barstow's plant there was a saving of something like 500 kw in station capacity, representing an investment of $50,000, if the station cost was taken at $100 per kw, and a saving in operation of $20,000 per year.

Mr. Barstow endorsed Mr. Hallberg's estimate as to the efficiency of the system. Everything considered, the system was enormously efficient as compared with present systems.

Mr. J. H. Perkins, of Wilkesbarre, Pa., asked as to the effectiveness with which the deposit from the magnetite sticks was carried out of the lamp by the chimney, and how much fouling of the lamp there was by the flames. Mr. Barstow said that lamp trimmers once every 150 or 200 hours ran a chimney cleaner down through the chimney. There was no particular trouble about keeping the deposit cleaned off.

Mr. Williams spoke of the extensive use which he had found of the flaming arcs in prominent streets in London and Paris. They had found such extensive use over there that they were an important factor. Unless properly placed they seriously interfered with the effectiveness of electric signs near them.

Mr. Scovil asked what prospect there was for cheaper electrodes and whether there would not be a great reduction in prices as there had been with ordinary arc lamp carbons.

Mr. Marks thought there was not much prospect of getting the cost below 6 cents, as it was now in Europe, where the lamps had been in use for some time—so much depended on careful manufacture of electrodes that we must not look for a great reduction. As to the use of these lamps in Europe, as spoken of by Mr. Williams, he said that in London and Berlin the lamps were placed high, which, of course, gave the best results. They were, however, rather expensive for conditions in this country. It must be remembered that in Europe the cost of energy is frequently very much higher and the cost of labor lower than in this country, both of which factors would favor the use of the flaming arc in Europe.

Mr. Louis J. Auerbacher did not agree with all Mr. Marks' conclusions. He thought that the association should be interested in learning the income producing features of this form of illumination. In the commercial field the flaming arc is helping the central station man to down the gas arc. The flaming arc will light up a store front more economically than any other form of artificial illumination. The light distributed is greatest where a merchant wants it, namely, at his store front, and not 300 feet up the street. The penetrating rays can be seen many blocks, and make the ordinary arc look like a glow worm. In Europe the gas arc has lost its hold as the cheapest commercial light, and the flaming arc has taken its place.

Mr. S. G. Rhodes, of New York City, said that Mr. Marks' figures of $4.25 per year per 500-watt enclosed arc lamp for maintenance is much lower than obtains in his vicinity. He agreed with Mr. Marks' conclusions, but called attention to the fact that the costs were rather higher for enclosed carbon arcs than Mr. Marks figures.

PRESENT STATUS OF THE STEAM TURBINE.

A committee consisting of Messrs. W. C. L. Eglin, I. E. Moultrop, J. D. Andrew, W. E. Moore and A. C. Dunham, who visited the works of the manufacturers of steam turbines, submitted a report describing the improvements which have been embodied in the turbines built by the several manufacturers.

All manufacturers are giving special attention to the design of the revolving-field generator. The General Electric Company has developed a design which apparently will overcome the difficulties due to changes in balance after the turbines are in operation. The new field structure that has been developed has been designed with distributed windings, with open spaces near the shaft, so that air can be received along the shaft and discharged by centrifugal force through the field laminations, and thus impelled through the armature laminations; the space at the ends being confined and arranged in such a manner that the air is positively forced through the inside outward. This air can be admitted at either end of the shaft, the intention being to close up the other end so that air is all taken from one end. The armature frame has no openings on its outer surface. The space between the laminations and frames at the end where the air is admitted is closed up. The air passes through the field and armature structures and then passes out at the end opposite that from which it has entered. Its flow is governed by a powerful centrifugal impulse, and it will consequently be possible to connect these machines by long pipes, if necessary, to points where cool air can be obtained, no blower being required in such pipes. As a rule, it will simply be desirable to extend such pipes to some low level in the station, where the air is naturally cooler than it is above turbines and steam pipes. These generators, having smooth rotors and no direct air communication outward, should be entirely free from noise. The total number of turbines of the Curtis type manufactured by the General Electric Company shipped or on order is 592 units, an aggregate of 580,325 kw. Of these, 385 units are of 500 kw or larger.

The Westinghouse company now has in operation 144 units having a total rating of 122,270 kw. It has shipped or on order 130 units, equivalent in capacity to 200,250 kw, making a total number of 274 units, an equivalent capacity of 322,520 kw.

The company is now building a double-flow type of turbine. The first stage consists of an impulse wheel with two sets of buckets, steam being admitted through three nozzles, two arranged at the top and one at the bottom of the casing. The steam after leaving the impulse wheel passes on to a series of Parsons blading. After passing through a second stage, assuming that the impulse wheel is the first stage, a part of the steam continues in the same direction through the blading, the balance being carried through openings in the cylinder to which the blades are attached to the opposite end to another set of Parsons blading and in this way balancing the thrust. The advantages claimed for this machine are that it obviates the necessity of the use of large balancing pistons and it materially shortens the length and reduces the diameter, making the machine more compact; for these reasons the design particularly lends itself to the larger sizes. Sufficient information has not been obtained to know whether the economy will be as good or better as compared to the standard Westinghouse-Parsons type. It is not expected, however, that this machine will supersede the machines that are now being manufactured, but in all probability it will be more suitable for certain sizes.

The Allis-Chalmers Company, which has recently entered the steam turbine field, has shipped or has under construction 17 turbines with a combined rating of 29,000 kw, the units varying in capacity from 500 to 5,500 kw. The principal difference between this type of turbine and the standard Westinghouse-Parsons turbine is in the mechanical construction, balancing pistons, blading, the governing device and some other details.

There was no discussion on the report.

MECHANICAL REFRIGERATION.

A paper by Mr. John Meyer discussed the elementary principles involved in mechanical refrigeration, and contained much valuable information concerning the operation of refrigerating machinery by electric motors. The quantity of refrigeration is now expressed in tons of ice melted. As the latent heat of ice is 142 B.t.u. per lb. there are required 284,000 B.t.u. for melting a 2,000-lb. ton of ice. The capacity of a machine is proportional almost entirely to the weight of ammonia circulated. This weight depends upon the suction pressure and the cubic displacement of the compressor pumps. The cost of installation

depends upon factors that are questions of engineering. The cost of operation depends also on engineering features which are similar to those encountered in the various forms of drives.

The accompanying table shows the required capacity in tons per day and the rating of motors needed for various refrigerating installations:

Business.	Capacity.	Hp of motor.	Av. temp. of box.	Av. hours to operate.	Refrigerating method.
Dairy	3 tons	7.5	38	8.0	brine circula'n
Grocery	200 lbs.	0.5	34	7.6	brine storage
Drug	3 tons	Com. 7.5 / Pump 1.0	33	Com. 4.75 / Pump 15.0	sweet water circulation
Butcher	3 tons	7.5	36	6.0	brine storage
Residence ...	500 lbs.	2.0	39	8.5	
Saloon	500 lbs.	2.0	40 min. / 45 max.	9.0	brine circula'n
Restaurant ...	500 lbs.	2.0	35 min. / 45 max.	15.0	direct expan.

Tests have shown that the cost of operating the small refrigeration machines by the electric motor at prevailing rates for electricity compares favorably with the cost of ice. This must be effected, however, by confining the use of electricity as nearly as possible to actual required temperature under proper insulated conditions. The advantages from use of the motor-driven machine more than offset the attention required, which, with a good machine, is nominal. Unfortunately, the owners of small plants have no idea of the conditions of operation, and they are thus rendered helpless to meet this question and secure the best possible method of refrigeration, which involves a minimum first cost with a minimum cost of operation and a maximum service value.

DISCUSSION.

In discussing this paper Mr. Leon H. Shirk, of Birmingham, Ala., asked whether in Philadelphia Mr. Meyer had found it necessary to make guarantees to new customers as to the performance of the apparatus. He had found trouble in getting customers to buy apparatus outright without guarantee either by the central station company or by the refrigerating machinery manufacturer, thus putting the company to the expense of installing the apparatus on trial.

Mr. Meyer said that the refrigerating plants placed in Philadelphia had been put in practically without expense to the company. The manufacturers of the machinery sometimes made guarantees.

Mr. W. W. Freeman, of Brooklyn, N. Y., said that they had organized a refrigerating department in Brooklyn after having convinced themselves that there were a large number of possible customers, but after a short time had discontinued the department for the reason that it was so difficult to get delivery of refrigerating machinery within reasonable time. They were ready to start again any time that the machinery manufacturers might be ready to deliver goods.

Mr. F. E. Matthews, of Hartford, Conn., speaking for the refrigerating machinery men, said that conditions were abnormal this year because of the warmer winter, and that these conditions would naturally correct themselves. It was but natural that owners of ice refrigerators after having waited until spring to discover that there was a dearth of natural ice would all want refrigerating machinery at once.

Mr. S. B. Storer, of Buffalo, asked whether any attempt had been made to take ice machine motors as non-peak load at a lower rate, because it would not come on the peak.

Mr. Meyer said that in Philadelphia they treated refrigerating machinery the same as any other power business. Much of it had to be on during the peak, so that they could not differentiate between it and other power.

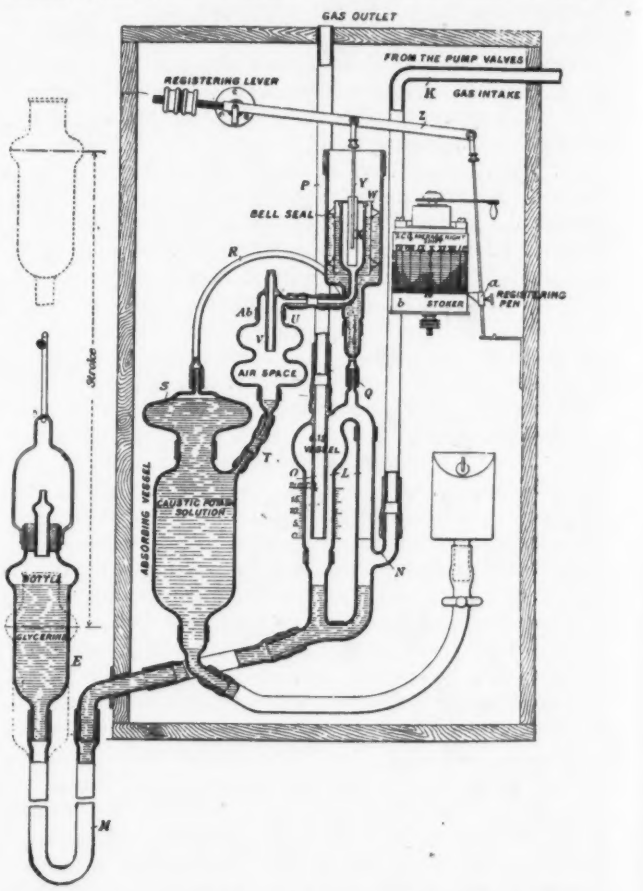
Mr. McGee said that at Red Oak, Iowa, he had some experience in that line with refrigerating machinery in butcher shops and large groceries which were taken under contracts which prohibited use during the winter peak. He found no difficulty in such contracts, the customers having sufficient brine storage in his refrigerator plant to tide him over the peak. Some of these contracts had been running five years without any trouble or objections.

AUTOMATIC CARBON DIOXIDE RECORDER.

In a paper read by Mr. J. H. Hallberg he described the Arndt automatic CO_2 recorder as a device which tends to insure the proper combustion of fuel and therefore contributes to the economy of operation of steam-driven generating stations. The working of the recorder is based on the fact that a solution of potash absorbs CO_2 gas (carbonic acid gas). The recorder consists of an air motor, gas pumps and analyzing and recording apparatus.

The air motor consists of a tank, a bell and fittings. The interior of the bell is connected with the chimney by means of a tube. The draft in the chimney creates a vacuum under the bell, which is pressed into the tank by atmospheric pressure. Air is then admitted into the bell by the automatic action of a valve, and the bell rises again. This motion recurs about every five minutes, and it is utilized to raise and lower a bottle filled with glycerine, and to drive a pair of specially designed pumps, which force flue gases through a tube from the chimney through the analyzing and recording apparatus.

Where the load on the boilers fluctuates, as it will in lighting and railway plants, the recorder instructs the fireman how to handle the dampers. The use of the CO_2 recorder enables the manager to get better service from his fireman, and in case of a strike it is possible to get fair results from inexperienced operators. The distribution of premiums to the fireman who maintains the highest CO_2 record will also suggest itself with the introduction of this recorder.



DIAGRAMMATIC VIEW OF ANALYZING AND RECORDING APPARATUS.

The gas pumps consist of two cylinders, which dip into oil tanks and rise and fall alternately, drawing flue gases from the chimney, and forcing them through the recorder. As the pumps deliver about twenty times the volume of gas required for an analysis, the same gas is never analyzed over again.

The analyzing and recording apparatus consists in the main of a glass tube, which serves as a measure to collect 100 cubic centimeters of gases, of a bottle containing a solution of caustic potash, which absorbs the CO_2 gas, and of a pen which records the percentage of CO_2 gas ascertained by drawing ink lines on a clock-driven chart in the usual way.

The gases that are to be analyzed are forced into the recording-cabinet by the gas pumps through the tube, *K*, which is shown in the illustration. Bottle, *E*, is periodically raised and lowered through the action of the air-motor and is in communication with the system of measuring tubes, *L*, by means of a flexible pipe, *M*. The bottle, *E*, is filled with a mixture of

glycerine and water in the proportion of one part of the former to three of the latter; and when the bottle rises, the liquid in the tubes, *L*, rises at the same time, and when it reaches the point, *N*, it closes the inlet for the gas from *K*. Contained in *L* is an inner gas-escape tube, *O*, which is connected with the atmosphere by the pipe, *P*. When the liquid reaches the bottom end of the tube, *O*, exactly 100 cubic centimetres of flue gases are contained in the glass vessel, *L*.

As the bottle, *E*, rises farther the gases in the vessel, *L*, are gradually forced through the tube, *R*, into the vessel, *S*, which contains a solution of caustic potash of 1.27 specific gravity. The whole of the 100 cubic centimetres of the gases have been forced over when the liquid in *L* reaches the mark *Q*, this being the point at which the air-motor reverses.

The moment the gases come in contact with the caustic potash in the vessel, *S*, the CO_2 is absorbed. The pressure of the remaining gases displaces the potash in *S* and forces it up the tube, *T*, into the air-vessel, *U*. When the potash reaches the bottom of the tube, *V*, which connects *U* with the atmosphere, a certain quantity of air is bottled up in the space above. When the potash has risen to the bottom of the tube, *V*, it has driven 60 cubic centimetres of air at atmospheric pressure out through the tube *V*; but on the potash rising further, it compresses the air in the upper part of the vessel, *U*, and raises the bell, *W*, which floats on a glycerine seal. In the bell, *W*, is inserted an inner tube, *X*, which is closed at the lower end. To raise *W* to the point where the lower end of *X* touches the rod, *Y*, twenty cubic centimetres of air are taken up, and the remaining twenty cubic centimetres (making up the 100 cubic centimetres) serve to raise the registering lever, *Z*. To this lever there is attached the pen, *a*, which draws lines on the chart carried on the drum, *b*.

The chart is calibrated in per cents from 1 to 20, and the time is marked on it. For every per cent of CO_2 absorbed, one cubic centimetre of air less is displaced, and the registering lever is made to rise one per cent less on the chart. It will therefore be seen that when there is no CO_2 present the pen will rise to the top of the chart.

DISCUSSION.

Mr. G. E. Claflin, of Boston, asked as to the cost of a continuous flue gas recording apparatus such as described. Mr. Hallberg replied that it cost $375 f.o.b. at the New York docks, to which $90 duty should be added.

Mr. L. R. Nash, of Savannah, Ga., said that no doubt the continuous recording device was better than any intermittent testing device, but nevertheless because of the cost of the continuous recorder his company was experimenting with hand-operated devices for making occasional tests.

Mr. A. J. Campbell, of New London, Conn., thought in practice the percentage of CO_2 did not decrease directly with the increased proportion of air. The recorder described did not record continuously but only once in 5 to 7 minutes. The value of such an instrument was nevertheless great.

OVERHEAD LINE CONSTRUCTION.

In a paper having the title "Line Construction for Overhead Light and Power Service," Mr. Paul Spencer quoted at length from the line specification recently prepared for the electric companies of the United Gas Improvement Company and of the Public Service Corporation of New Jersey, in which the points considered in the order of their importance are the safety of the public and of the company's employes, the reliability of the company's service and the sightliness of the construction.

To meet these requirements there should be used structurally sound material, of ample strength to withstand, under all conditions of service, the strains to which the line may be subjected. The poles should have not less than 7-in. tops, should be set not less than 5 ft. in the ground and be held firmly by substantial guying against side or end pulls. The cross arms should be of sound, honest wood, and not the sap wood variety, which are covered with so-called red paint to hide their defects, and which are made up of the leavings of the mills after the good wood has been cut into building timber and flooring. They should be firmly bolted to the pole and should be braced.

The line wires should be not less than No. 6 B. & S. gauge in size, and they should be strung with ample clearance over highways and footways and should be inaccessible to the general public from bridges or buildings. The guy wires should be of stranded cable and not solid wire. They should be insulated and, so far as possible, installed so that they cannot be easily reached from the ground. Ground wires should not be installed unless they can be connected to a permanent and effectual ground. A ground wire connected to a poor ground not only fails when it becomes charged to give the protection for which it is supposed to be installed, but becomes a positive source of danger to the passer-by.

For the safety of employes, pole wiring should be carried out in a systematic manner, so as to leave space on the pole for climbing and working thereon. To protect the trimmer, series-arc lamps should have absolute cut-outs. Due consideration should be given to the wires of other companies in the territory. It must be remembered that the telephone and fire alarm wires have much less mechanical strength than the line wires used by electric light companies, and that in case of sleet storms they are the ones that are likely to break and come down, making possible contact with the electric light wires. The stable and proper installation of guard wires in a general distribution system is impracticable, and as they would generally have to be installed they would increase rather than lessen the chances of trouble. When electric light, fire alarm and telephone wires must be run in proximity, the best results to all concerned and to the public will be obtained by having the electric light wires on top, above all other wires.

Sightliness of construction will be best obtained by having the work done in a systematic manner, and by using poles of a uniform height and size, set and maintained perpendicular. Systematic pole wiring, with taps for transformer connections and for branch circuits led across the pole horizontally and dropped perpendicularly will do a great deal to help the appearance.

BUSINESS-GETTING METHODS.

Mr. Frank W. Frueauff presented a paper entitled "Business-Getting Methods," of which the following is a reprint:

The most serious problem confronting the central station manager of to-day is the matter of rates at which electricity for lighting or power purposes shall be sold. With the present tendency toward either municipal ownership or municipal control and regulation of rates, it is more necessary than ever before that the company shall give constant attention to the revenue end of the business.

None of the savings in generation or distribution now known to the fraternity can materially reduce the costs of manufacture nor eliminate the fixed expenses or current losses, but by a constant increase in the volume of desirable business, a company can reduce its average cost of current, due to the fact that the fixed expenses, either for consumption or demand, will not grow at the same rate as the output costs. It is therefore more and more evident that we must hope to follow the plan of the larger mercantile establishments in looking for future growth in large sales at relatively low prices rather than small sales at high prices.

It is to the credit of most central station managers that they are to-day awake to the possibilities of increased sales of current and that most of them are making an effort to bring their rates to a point that will attract and satisfy the majority of their consumers. In the taking on of new business it is therefore necessary for the company to consider the kind of business to be secured, bending its efforts to attract and cultivate the desirable business and to discourage, as far as possible, the undesirable business.

The writer will make no attempt to go into the matter of rates or costs, but simply calls attention to the fact that in making the rate to the consumer, in order to attract the desirable business, the cost of supplying that service should be borne in mind, and the matter of averaging costs, which have been so misleading in the past, should, as far as possible, be eliminated.

We can never hope to eliminate all of our unprofitable business, and so long as public service regulations remain as at present it seems impossible for us to be able to put all of this undesirable business where it will at least be self-supporting; but if the

volume of desirable business can be built up so that it constantly bears a larger proportion to the total, the undesirable business can be made a less noticeable burden.

We all realize that a perfect load factor is our ideal, and that the better our load factor can be made, the more closely have we approached success. So far as the lighting end of the business goes, the developments of the last few years have shown that long-hour display or advertising lighting presents the most opportunities for improving the load factor. The tendency toward this class of lighting has spread like an epidemic over the entire country, and it has now come down to simply a question of how to get the business.

The use of electric power, particularly through the daylight hours, is another feature that commends itself to the central station, and is doing much to build up the steam load factor, giving us better station results, particularly in the line of boiler fuel and station labor costs.

How, then, to secure the desirable business is the problem before us. The company realizing the difference between the desirable and undesirable business must necessarily make efforts to secure business along systematic lines, for if this distinction is overlooked we are soon apt to take on, inadvertently, business that requires a larger and larger investment without adequate return.

We have all passed the day when we feel that business will come to the office and we must simply provide means to take care of it. It is now up to us to put ourselves in the position of the merchants with wares to sell in competition with others, and we must go out and find our market and convince the customer that our wares are the ones that will bring him the greatest profits and the greatest convenience.

The writer feels that the best results in getting business are secured through systematic solicitation followed up and interwoven with general and personal advertising. We must see our customers, know their wants and aim to supply them. In many cases we must begin by creating a desire for what has seemed a new article or an expensive luxury. Solicitors or representatives must be thoroughly drilled in their work and should be conversant with the general methods of manufacture, in order to intelligently approach the possible user.

We have found that best results are secured by a constant interchange of ideas among the men engaged in the same line of work, and by a constant and continual drilling and education of the men by some one well posted on the subject. At the outset, it is well for a new man to go about with one who has solicited before, and in that way learn the general line of arguments that are used to induce the consumer to buy; to learn to make a favorable impression upon the prospective consumer, how to adjust complaints, if made, and how finally to close an order. We have found that while many men are thoroughly posted on the advantages of the use of electric light or power, they are not able to hold the interest of the customer, and it is of prime importance that they know how to present the proposition.

Too much attention can not be given by the representative to the complaints, either real or imaginary, which come to his notice. One dissatisfied consumer in a district can undo weeks of work of the most capable representative, and the satisfactory adjustment of a complaint has often resulted in an order, and has made the consumer an active solicitor for the company.

With business men, as well as with the housewife, much of their conversation is taken up with the comparison of their methods. The man with the well-lighted store explains to other merchants his reasons for the lighting and the benefits he has derived, just as the housewife with electric light in her home tells of the advantages it has over oil lamps and the other antiquated methods used by her neighbors.

As the class of business secured by the representative may be good or bad, it is necessary that he should be encouraged in attracting the best business and discouraged in taking on the poor. A contract bringing a revenue of $100 a year from one consumer may carry with it a very satisfactory profit to the company, while the same amount of revenue from another party may prove wholly inadequate to pay the costs occasioned, so we have felt it necessary to make our basis of pay to the representatives follow this plan; making the remuneration to the man increase as the value of the business secured increases.

Too much stress can not be laid on the satisfactory results that can be secured by judicious advertising in connection with the visits of the solicitor. It is often impossible for a merchant to give a solicitor any of his time when he happens to drop in to see him, and by the use of letters asking for an appointment, stating clearly why an interview is sought, time may be saved for the company and for the merchant, for he is waiting to receive you if he has made an appointment.

The sending of attractive advertising, showing forcibly the benefits to be derived by purchasing what we have to sell, will enable the representative to close many orders, and letters then may be sent out after the visit of the representative, bringing out any points that were left open in the interview with the representative, which can be forcibly set out here and may be given more thought by the merchants than if merely a part of the conversation.

The sending of letters to prospective customers unless followed up within a reasonable time by a trained solicitor can not be expected to accomplish results. Many people are in a receptive mood after reading advertising matter, and if we can call and see them soon after, we can get their business, but they will not take the trouble to go down and look for the man who has it to sell. This applies in every line of business, and probably more so in ours than with the so-called retail establishments.

One of the very important features in the getting of new business is in the persistency that is used by the company. We can hardly hope to secure results that would justify any part of the expense of a new business campaign unless it is followed up persistently and systematically.

One visit to all of our consumers or prospective customers will not accomplish much. In many cases the first visit will scarcely give the solicitor an opportunity to meet the consumer, or the entire interview will be taken up with the discussion of the company's policy or in the discussion of some grievance, but it must be borne in mind that these interviews, while not directly productive of good, in the long run are bound to pay handsome dividends.

Our experience, covering a period of several years, shows that the most of our orders are closed after the fourth or fifth visit, and that practically no orders are taken the first time a prospective customer is seen. We have found, too, that where solicitation has been followed up and interwoven with general advertising and with special letter writing, the number of visits has been cut down and the orders secured on an average of about three visits.

The statements just made apply only to the business and commercial districts. In the residence districts we have found it comparatively easy to secure lighting orders on the second visit, but it takes a great many visits to increase their consumption through special uses, such as for long-hour burning of porch lights and the use of special appliances, such as sewing-machine motors, curling-iron heaters, chafing dishes and so forth.

Coming down to a specific branch of business-getting, we strongly recommend the use of specialists in particular lines. For example, we have found that a man well versed in the building and designing of electric signs is of material assistance to the representative; that is, while the representative is able to interest the merchant in a proposition for a sign and to convince him of its desirability for his business, if he can then bring to the merchant a man who can give him ideas on how his place may be lighted and advertised to bring out his particular line, it will bring more satisfactory results for the merchant and will usually enable us to secure a larger and more permanent proposition.

We have a man who devotes all of his time to drawing sketches that are submitted by the representative and sign expert. Oftentimes half a dozen sketches are submitted, after the merchant has concluded to put up a sign, before any of them catches his fancy, but it pays well to go to this expense and have him thoroughly satisfied at the outset that he has something particularly adapted to his case.

It is the same with the solicitation of electric power. A special man, who is thoroughly posted on the adaptability of electricity for motive power, can bring the merchant to the closing point much more quickly than if the work is undertaken

alone by some man who is fairly well versed in all parts of the business but is not a specialist in this line. We all like to feel when buying that we are doing business with some one who knows thoroughly what he has to sell and how it can be applied. The use of these specialists in connection with the regular representative will tend to impress the prospective customer with the reliability of our proposition.

Another specialist who is of great value to the lighting company is a man to follow up new buildings. He can arrange with the architects when plans are drawn, and advise with the builders as the work progresses, as to how the building shall be wired and the general scheme of illumination.

We have realized the importance of an illuminating engineering education on the part of some of our representatives and at present have a number of them taking a special course with an illuminating engineer of national prominence. We have found their ideas, when presented to the merchants, have been highly appreciated, and we believe that as time goes on there will be a noticeable improvement in our methods and standard of illuminating, due to the fact that they are considering the lighting of the places from a thoroughly professional standpoint and not, as has been our trouble in the past, in trying to see how many globes can be crowded into a given space and enough lights secured, overlooking the thought of its artistic or economic effects.

Careful records should be kept by the representatives of the work they are doing, and records kept in the office of the possibilities outside. Here, again, we find that system plays an important part. With the records kept of the date when the consumer was last visited and the results of the last interview, much time can be saved in going out again and in knowing how to approach him and knowing what his needs are.

One of the most profitable sources of business lies with our present users in increasing their standard of illuminating, and, with business houses, in impressing upon them the possibility for display lighting. This particular part of the business is to be commended. Practically no further investment is needed to secure this business, consequently the profits are very much greater than where new connections have to be made, and once having made a start with the merchant it is easier to get him to use more. With many of our sign, window and outlining consumers we have increased their use of light two or three-fold, as the advantages of this class of business have impressed themselves on the merchant's mind.

Another feature we should not overlook in the active solicitation of business is the friendly feeling that will eventually grow up between the consumer and the company. Our greatest handicap to-day is that the offices of a company and the heads of departments can not personally know each one of their consumers; but if we can delegate this work, as is practically done, to the representatives in any given district, the consumer soon comes to feel that he has some one who stands between him and the unknown company who will gladly go to the front for him and see that his troubles are remedied and that he receives individual treatment, which is so important in these troublesome days.

The force of example is one that commends itself strongly. If the company itself is not a liberal user of its commodity it may create a distrust in the minds of the users, but if the company can make its office or its building a land-mark it has a wholesome effect in convincing the prospects that there is something in display lighting. I believe every company should aim to keep itself in the foreground as the most liberal user of light in its city. It will tend to encourage others to try it; and as the standard of illumination of the company increases so will the standard among the merchants increase. A healthy rivalry of this kind is the best for all concerned. It will build up a feeling in the community that you are enterprising and it will convince the individual that if it is good enough for you it will be good for him.

Summing up the conclusions briefly, I feel that business-getting methods may all be embraced in going after the business systematically, persistently and discreetly, and the more of this that is done the faster the company will grow, the safer its position will become in the community and the greater its earning power for its stockholders.

HOW TO MAKE A SMALL ELECTRIC PLANT PAY.

Mr. D. F. Mager presented a paper with the above title describing the methods adopted to transform into a dividend-earner an electrical property, operating in a town of 5,000 population, that had previously been a losing investment. It has been proven, he said, that an entirely modern equipment is not essential for the financial success of an electric plant, and a wise manager of a small plant will hesitate before he consigns to the scrap heap equipment that he might, by overhauling and judicious arrangement of same, be able to operate at a net efficiency equal to the most modern equipment, besides saving for his company the amount required for new equipment and increased fixed charges that must necessarily follow such an expenditure. On the other hand, if he finds that his requirements and conditions call for an entirely new installation, he should not hesitate to make it, provided he can get the funds to do so—which is often difficult in a small plant.

The boiler room is usually the most neglected part of a small plant equipment. Uncovered pipes, leaky valves and joints, improper boiler setting, careless firing and injudicious selection of fuel, are a few of the dividend-consuming devices common to small plants. It is well to have as few different sizes of valves, fittings, etc., as possible in the piping equipments. By making the nipples and short pieces of pipe of some uniform length, repairs will be simplified and many a shut-down be prevented, and a much smaller stock of fittings will provide for emergencies.

Boilers should be inspected at regular intervals and kept free from scale. Scale in boilers is often the cause of enormous waste of fuel. Every steam plant should have recording thermometers installed in the feed-water lines to boilers. The average engineer in the small plant does not realize the necessity of heating boiler feed water to, at least, 200 degrees.

Many central-station managers would have a rude awakening if they would take the trouble to install recording instruments. Recording voltmeters, as well as thermometers, will provide a healthy incentive for men to attend to their duties, and will also provide a means by which that mystery of voltage variation, which has given so much trouble at various times, may be solved. It is well known that one of the chief difficulties in small plants is to have competent help available when accidents or other trouble occurs, which is generally during the time of the heaviest loads. This has been provided for by dividing the power-house force into three watches, with the understanding that they are to work ten hours per day. This provides double force on duty two hours each day to make all repairs and tide over the peak-load period.

Engines should be indicated regularly, and valves adjusted for the most economical steam consumption. Tests of water and fuel consumption should be made at stated periods. A log book should be kept, showing records of the hourly readings of the various instruments. Daily readings should be made of the switchboard wattmeters. No plant is too small for those instruments. If a plant cannot afford load-curve drawing instruments, the engineer or switchboard attendant should plot the daily load from the ammeter readings on sheets similar to Fig. 1. The curve thus drawn will bring out plainly the hollow place in the load line that must be filled before one can corral that dividend-earning germ which all are striving to cultivate with more or less success.

The distributing system of a small plant is very often the source of considerable waste. The annual losses from poor line construction, inefficient transformers and badly designed feeder systems, would go a long way toward paying dividends. The line and transformer losses on the above-mentioned plant at present are only 60 per cent of what they were five years ago, when the income was only 25 per cent of the present earnings. Thirty transformers were scrapped and the entire lot replaced with four large ones, using three-wire secondary network with banked transformers to take care of this large increase in business.

The first duty of every manager is to provide for reliable and continuous service. He must furnish "the goods." Excuses won't go with the up-to-date American citizen. His next duty is to his company. He must see that it receives an equitable return for money invested by it to provide the equipment to

supply this service. Before he can do this, he must first know, beyond question, what constitutes the various costs that go to make up the entire operating expenses of the plant. He must be able to make a monthly comparison of his various costs, for it is only by this means that he will be able to keep a check on his operating expenses. By studying carefully all the facts and factors that constitute his costs, the manager will be able to steer clear of the folly of taking unprofitable business.

In plants located in cities with populations of ten thousand and less, the manager must be familiar with every detail of his business. He must be his own solicitor. It has been said that an outside man can interest and get customers that the local manager can not reach. If he can, it is because he is a man better fitted for the business. The manager of a small plant should know ways and means of approaching a prospective customer that a stranger cannot know. He should study the ambitions and weaknesses of every prospective customer. Often it is the wife and mother that should be approached, perhaps in an indirect manner. Very often it is the daughters of the house, who aspire to have as many conveniences as their neighbors. A hint from any source should not be neglected. There is always some way to land an interested party. A manager is not worthy of the name if he cannot find a way to do this.

Above all, a solicitor must be specific, and must be thoroughly posted regarding cost of installation and cost of operating the article sold; also regarding maintenance of same. He must be able to say, "Buy this; it will cost you so much to install and run, and will give you so much profit." He must be able to meet any argument that may be advanced by his competitors. Above all, he must be truthful. He must not make rash promises. It is well always to allow a factor of safety in this respect. How gratifying it is to hear from a customer that he is getting better results than you promised him. An incident that afforded considerable pleasure as well as profit was the case of a German who owned a blacksmith shop in the little city. After a lot of hard talking he installed a small motor to operate his tools. Some time after when asked how he liked his power, he replied, "One boy put that thing in here, but it would take several good men to get it out again." As he is a very profane man, he used much more forcible language to express himself on this subject. This story has been told many time since, and it has helped to close up the sale of a good many motors.

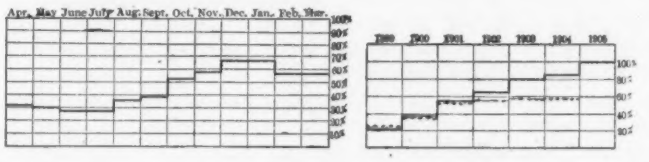
It is not necessary to be a "hale fellow, well met." A man does not have to be a "mixer" in the accepted sense to get business. That fallacy has been exploded long ago. A pleasant, cheerful manner and character to back up his arguments, is his best stock-in-trade.

The manager of a small plant must keep posted regarding the latest and most efficient types of different apparatus, lamps, reflectors, and so forth. He should read all the trade publications; not only the reading matter, but he should study the advertisements as well. He will miss a great deal of valuable information if he does not. He will often find the solution in those pages of some difficult problem that has bothered him for months. Many manufacturing concerns gladly furnish binders for their literature. This matter, when properly assorted, represents a mass of valuable information that can be acquired in no other manner, so there is no excuse, save "that tired feeling," for a central-station manager not being up-to-date.

It is somewhat difficult to convince a customer that if his requirements call for a 25-hp motor, he would only have to pay for five to ten horse-power. A very large proportion of the load that can be secured by a small plant is intermittent. The customer averages a payment for only about 25 per cent of his actual installation. By carefully studying the requirements of all prospective customers and becoming familiar with their actual costs, one is in a position to go to any one of those customers with a proposition that will save them money. If the average man can be shown that his expenses can be cut down or his manufacturing costs decreased, there will be no difficulty in getting his business.

One of the most desirable classes of customers is the small refrigerating plant, especialy in connection with brine cold-storage tanks. Arrangements can be made with this class of customers to shut down their motor during peak loads. The cost of this class of power would be only the net additional cost of fuel and proportion of your general expense, as it does not increase the peak load on the station. A careful analysis of costs will work wonders toward helping the manager of small plants in building up that hollow of low business in daytime.

The manager must be able to plan the most efficient arrangements of machines. In very many cases, such as machine shops, grouping the machines will permit the most efficient operation. In other cases, such as printing plants, individual motor drive is preferable.

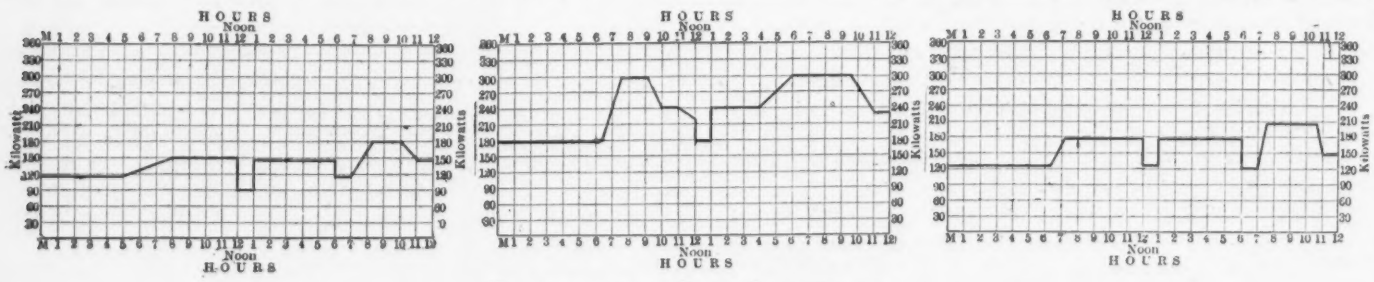


FIGS. 4 AND 5.—LOAD FACTOR CURVE AND RATIO OF OPERATING EXPENSES TO GROSS EARNINGS.

It pays to study every installation, giving the prospective customer the very best advice, for there is no advertisement so cheap and good as a satisfied customer. Above all, create confidence, for confidence is the foundation of new business. Pay every attention to the little things. The average user of power knows nothing at all about electricity or mechanics and cares less. What he wants is to see the wheels go round. Have your trouble man call at the various installations at stated intervals, making a report to you of any abuse or misuse of the equipments. The average patron will appreciate this. He can well afford to pay a small sum for this inspection to insure him against a shut-down.

One of the best means to increase business is to co-operate with architects and builders. The advice of a disinterested party will go a long way with the house owner.

Be prompt in looking after trouble. Let your customers know that their troubles are yours. Make yourself and your service indispensable to them; keep posted in regard to the troubles of users of other sources of power. The author stated that he has often taken advantage of a breakdown in both steam and gasoline engines to install a motor to help them out of a difficulty, and there has never been an occasion to take the motor out afterwards, as the engine would invariably pass to the second-hand man.



FIGS. 1, 2 AND 3.—DAILY LOAD CURVES.

With all due respect to advertising, it must not be thought, however, that the getting of new business, in a small city, is dependent on advertising alone. There must be good and reliable service as a foundation for all this. The service must be continuous and free from interruption. Voltage must be steady. With such good voltage regulators on the market, there is no excuse for poor regulation. Customers' installations must be looked after by the central station manager to insure their being

maintained in good condition. He must watch the little things, keep dim or other inefficient lamps weeded out. At an early date we adopted a liberal policy regarding free lamp renewals.

It is also essential to have a schedule of rates that will attract the long-hour or all-day customers for both light and power. You must educate the people away from the idea that electric light is for the well-to-do only, for the difference in the yearly cost for redecorating houses where electricity, gas or kerosene is used will often more than pay the entire electric light bill for the year. Where electric light alone is used, the redecorating cost is about one-half as much as it is where the other illuminants are used.

Regarding advertising in local papers, it is very necessary to retain their good will, and some money can be spent in this manner to advantage. A short time ago there was an epidemic of burglaries, and to one paper was furnished a news item, supposed to be an interview with a reformed burglar, stating that he always gave an electrically-lighted house a wide berth while he was in the business, because he never could tell when a light would be snapped on him from an upper story. To another paper a news item was furnished to appear as a statement by a noted detective, advising people to have their houses wired so that the lights in the lower rooms could be switched on from an upper story, an electrical journal having furnished this hint. More benefit was received from this one item in one issue of two newspapers than would have received from a bona-fide advertisement running a year in the same papers. The idea is to take advantage of the psychological moment to instill a proposition into the minds of prospective customers.

Advertising novelties are of questionable value to small plants. Every manager finds upon his desk every morning a mass of advertising matter, which he immediately consigns to the waste basket. There may be valuable matter hidden somewhere in this mass. The average manager has too many duties that demand his attention to waste it in wading through so much trash to discover them. Every business man has similar experience. It has been found that the better way is to install a number of the articles, the sale of which it is desired to push, in a number of carefully selected places, where they will be seen and talked about; and this, after all, is the only result to be gained by advertising. It is then up to the manager or his solicitor to strike while the iron is hot.

The accompanying figures show the results obtained by the above methods. In Figs. 1, 2 and 3, the curves indicate daily kilowatt output for different periods of past six years. Fig. 4 represents the load factor of the plant described. Fig. 5 represents the ratio of operating expenses to gross earnings for the past six years.

The accompanying figures show the result obtained by the above methods. In Figs. 1, 2 and 3 the curves indicate the daily kilowatt output for different periods of the past six years. The horizontal lines show the kilowatts and the vertical lines represent the hours of the day beginning at midnight. Fig. 4 represents the load factor of the plant described, and represents the total capacity of the plant in kilowatt output for the year of 365 days operating 24 hours per day, as registered by switchboard meters during each month of the past year. There was no current generated during daylight hours, on Sundays and legal holidays, thus making a total of 560 hours during which the plant was shut down during the year, or over 6 per cent of the entire time. Fig. 5 represents the ratio of operating expenses to gross earnings for the past six years. The faint dotted line represents the operating expenses, insurance and taxes for the years, and the heavy lines the gross earnings. This chart shows the necessity of putting a plant equipment in the best possible condition before it can be hoped to get the operating cost as low as is consistent with first-class service.

METHODS OF SECURING AND RETAINING BUSINESS.

The above topic was discussed by M. E. Turner, N. T. Wilcox, G. N. Tidd, R. S. Wallace, G. B. Tripp and L. H. Scherck. Mr. Turner touched briefly on some of the methods that had been successfully employed in obtaining and retaining business in Cleveland. Business, as defined by load increase, he divided into three classes: the securing as patrons of the company tenants of newly-erected buildings; the introduction of electricity where other illuminants or modes of power are used exclusively; increasing the use of electricity where it and competitive means of lights and power are used. He shows how these three classes are handled in Cleveland and says that a sales department should have its efforts complimented by the work of illuminating and mechanical engineers who make a study of illumination and power economies, keep posted on the newest and best in their line, are thorough and practical wiremen, and who can estimate closely the cost of work. A department thus equipped, he claims, assures that electricity will be more greatly advertised through the satisfaction of, and the economy to, the users. He called attention to the fact that while it may be necessary for a sales department to have a complete "follow-up" system, to publish a monthly bulletin or advertise, to employ expert light, power and heating engineers, it is more essential that all the solicitors should be proficient in their various lines and should be trained to work as a unit and to use the services of experts where expert advice is required.

Mr. Wilcox believes that the best way to interest prospective customers and create a desire for electricity is a practical demonstration on the customer's premises. By this means any solicitor of ordinary ability can obtain business much more readily than a more able man without such a demonstration. He employs men from his operating force who are ambitious and willing and gives each a definite district. While this method of soliciting is costly when cut-ins, transformers, meters, fuel, etc., are considered, he claims that it is not more so than printer's ink, postage, solicitor's time, etc. It is his firm belief that money spent for demonstrations, installing proper appliances where they can be used to advantage, etc., will amply justify the expenditure and make central station managers wonder why so many have forgotten this practical and efficient old-fashioned method of getting business.

Mr. Tidd claimed that the most unpromising field can be made productive to an unexpected degree by simply pushing the sale of electricity by the usual commercial methods. Some of the methods used by him that have been productive of results are circular personal letters, newspaper advertising, display room and various schemes of contract. With reference to the last, he employs in addition to the ordinary quantity basis, a two-rate contract, planned along the lines of the Wright demand scheme; a flat-rate contract, a flat-rate sign contract, a wholesale quantity contract, based on long-term contract and high guarantee, and a flat-rate motor contract, avoiding overlapping the peak, all of which are available to any customer. His company has an efficient method of treating complaints, but anticipates these for the most part by having solicitors call upon customers to see that they are obtaining the best results.

Mr. Wallace stated that while central station operators generally recognize the value of a new business department and realize that the ability to sell their service is fully as important as the ability to produce it, they thought special aptness and training were required and have thus delayed taking up the work. Once a start is made persistent seeking, he says, will develop business in the most unexpected places. As essentials of a well-organized new business department he broadened on the following topics: solicitors, co-operation with employes, salesroom, catalogues, appliance policy, new business index, publicity, cultivating publicity, newspaper advertising, mail campaigns, and co-operation with contractors.

Mr. Tripp maintained that while the question of obtaining new and profitable business is of first consideration, the retention of such business was not less important. He described the business-getting methods employed at Colorado Springs and on the question of how to retain profitable business he offers the opinion that if business is to be held the following must obtain: The rates for service must be as low as possible; the service must be maintained at the highest standard, and it should be the general policy of the company to deal with the public frankly, with nothing to conceal, and to be ready at all times to answer sensible criticisms. He attributes much of the municipal ownership agitation to a disregard of this general policy.

Mr. Scherck outlines a campaign for a contract department based upon experience in many Southern cities. His company has built up an immense sign business by furnishing, erecting and maintaining signs at a flat rate price per month on contracts

varying from one to three years. In three cities in which his company operates an ordinance has been passed not only granting permission for electric signs across the sidewalk, but compelling parties who get the privilege to keep these signs illuminated until at least 9.30 every night and have a certain number of lamps per square feet of sign surface. His company also does some free wiring, offering to wire six outlets in a place, the customer paying for the flexible cord and sockets and all fixtures and in addition guaranteeing a minimum monthly bill of $1 for a period of one year. Fans are rented at $1 per month and this has resulted in a large fan business, the price being more than ample to pay the interest and depreciation charge as well as repairs. A prize is offered every few months to the employe who brings in information of the most value to the company. As means for retaining business he mentions good service, an efficient meter department, the avoidance of special rates, liberality in the matter of small repairs and lamp renewals, prompt attention and courtesy to all complaints, and politeness of employes.

DISCUSSION.

Mr. Scherck, in presenting his part of the paper in abstract, emphasized specially the sentence in the paper by Mr. Frueauff calling attention to the greater security of a company's position in a community when it was systematically and discreetly working for new business.

President Blood said that Mr. Scherck emphasized one point which was coming more and more to the front. This was put to the solicitors of the Boston company by Mr. Hale in as few words as it could be said. His remark was something like this: "We are selling several kinds of kw-hours. Some of our kw-hours cost a dollar an hour and we get perhaps twenty cents for them. Others cost us half a cent and we get two cents for them. There is a great deal more profit in the two cent an hour customer than in the twenty cent an hour customer."

Mr. F. W. Smith, of New York City, told of a campaign in a new section of that city to secure as customers the tenants of apartment houses which were already wired. Names of non-users were obtained from hall boys and janitors, and letters were sent. The first letter was followed by a second letter. Nine per cent replied, and 75 per cent of those who replied made contracts for service.

Mr. M. S. Seelman, Jr., of Brooklyn, disagreed with the statements made in some of the papers that advertising should be general, and that the only results we can look for from advertising are general. He believed in advertising a specific proposition. In Brooklyn energy is sold directly as the result of advertising campaigns directed along specific lines. No circulars were sent out without inclosing a return post card. Use was not made of postal cards, as they are more expensive and did not produce any better results. They had recently placed 1,300 fans which had been bought at an unusually low price, these fans being sold mainly through advertising by means of circulars and return post cards. In connection with retaining business, he thought it advisable for all companies to watch the customer's bills, and if there was any marked dropping off in the bill to call to it the attention of the executive officer of the sales department. These are the cases where the patrons are apt to be dissatisfied and to have a grievance; if they are followed promptly it can be straightened out, and business retained which otherwise would have slipped away.

Mr. John F. Gilchrist, of Chicago, thought perhaps Mr. Frueauff in his paper, previously read, had made one point more strongly than he had intended. The inference from his paper was that he advised looking after good business and rather fending off poor business. Mr. Gilchrist believes we have reached a point where we must go after all the business that we can get. Most of us use differential rates and they are in a measure taking care of the difference between good customers and poor customers. We must remember that the man whom we consider a poor customer is one of the factors in public opinion in our community. For example, in Chicago in the last three months, in connection with rate regulation by the City Council, the company was much pleased to think that it had a large number of customers on its system upon whom it was actually losing money. This fact was brought out by the report of a very able committee, consisting of Mr. B. J. Arnold and City Electrician Carroll. It was a point favorable to the company. The rates to which they referred were 15 cents for the first 30 hours' use in a month and 10 cents per kw-hour for additional use.

He believed thoroughly in paying commissions to solicitors. They had done it in Chicago for two or three years after hearing of the experience in Brooklyn. They started in with the plan of assigning to each solicitor a certain amount of business which they expected him to get in his district, the amount depending on the district. For example, some of the downtown solicitors were expected to get the equivalent of 20,000 16-c. p. lamps in the year and in the outlying districts they were expected to get over 3,000. After this amount of business had been secured for the year they paid a small commission on each 16-c. p. lamp plus also a commission per customer. The commission was 1 cent per 16-c. p. lamp purchased, and 50 cents per customer for all over and above the specified assignment. This gave very good results on the yearly basis, but they had revised this in the past year, and now pay commissions monthly, because they found men would work better for a commission paid monthly than for one which was several months in the future. Commissions are not paid until the load is actually connected to the system. Many men now earn a commission who never did before with the yearly payments. Men average $7 or $8 per month on commissions.

Mr. W. H. Gardiner, Jr., of Boston, thought that almost any company could show unprofitable customers on its books before a committee of investigation. As to what customers we should seek it seemed to him we should seek unprofitable customers only if they can be developed into profitable customers within a reasonable time. He told the story of a company which pursued a policy as to rates which gave a new and enthusiastic competing company all the unprofitable short-hour business, while the profitable long-hour business went to the old company. The new company had an enormous increase in business, and thought it was on easy street, but its operating expenses were going up faster than its receipts and its finish came very rapidy.

Mr. J. C. Codman, of Boston, agreed with what Mr. Scherck said about avoiding special rates. It seemed to him of great importance to have the rates of any company thoroughly well known and published so that everybody knew exactly what they were. In this way many misunderstandings were avoided. He found this very frequently, however, not the case. He had many times gone, as an experiment, into the offices of an electric light company and asked the application clerk for a copy of the rates. He often found there were none printed, and that he could not even secure quotations without seeing the manager.

Mr. John Craig Hammond called attention to another phase of the soliciting and advertising question. In Denver, where the good will of the public had been sought for several years by such a campaign, the Mayor and Common Council had gone to the different cities and investigated the lighting conditions, always coming back and reporting that Denver was one of the best lighted cities in the country, and that it had one of the fairest companies they could find. Still, when the company recently asked for a franchise the municipal ownership question came up. A half dozen corporations were seeking a franchise at the same time. The company made a house to house canvass, but when the votes were passed it was discovered that the Denver Gas & Electric Co. had eight to one votes more than any other corporation. Mr. Doherty had told him that 80 per cent of the votes secured by the Denver Gas & Electric Co. on this franchise issue were due entirely to the efforts of the solicitors.

On motion of Mr. C. H. Herrick, of Boston, it was voted to have the president appoint a committee of five members for the purpose of investigating, collecting and reporting methods of sales of electricity, such committee to report to the next annual convention and to be called the Committee on Exploitation.

Mr. Geo. B. Stetson, of New Bedford, Mass., said that as a result of the investigation in his city, they had found that 15 of their customers paid the company more money than 400 of another class. The necessity of investigating rates came entirely from talk of the 400 that were unprofitable. The cost of serving a customer according to the figures established by the Commission of the State amounts to between $20 and $30 per year. The majority, nevertheless, paid less than $1 per month.

Mr. Harold Almert, of Chicago, said that recently at the convention of the Northwestern Electrical Association in Chicago he had stated that he marvelled at the lack of progressiveness and enthusiasm on the part of managers in towns of 5,000 and under, as to this new business-getting proposition. This was resented by some, but some knew that the statement was correct. The manufacturers have realized this lack of progressiveness on the part of small central stations, but have kept quiet for a long time in the hope that sooner or later these small central stations would wake up and realize the situation. But they do not seem to have done so, and for that reason he was glad to see the Co-operative Electrical Development Association arranging for suitable doses of information with which to inspire this class of members. He believed that this Association should make a special effort to reach this class of members and educate them and bring them to a realizing sense of what their influence is. If this is done a great deal of this adverse legislation and municipal ownership agitation to which we are subjected in the larger companies will be met in a very desirable way. He urged manufacturers in dealing with subjects of this kind to give more complete statements as to how these little fellows can get at this class of business. It must be realized that in the small stations all these various specialists in new business-getting departments must be embodied in one man.

ELECTRIC SIGNS.

The paper by Mr. John F. Gilchrist gave a report of the electric sign business in the United States and discussed "free" electric signs as a factor in central station prosperity. A conservative estimate of electric signs in the United States places the number at 75,000 consuming an average of not less than 480 watts each, or a grand total of 36,000 kw. At an average of 8 cents per kw-hour, the hourly income from these signs would be $2.880, and the yearly income at four hours per night $4,204,800. One central station has installed one 12-light sign to every 75 people in the town; in other towns the proportion ranges as high as one sign to 23,000 people, the average for the country being one to 988. The author stated that no central station man who has failed to put into effect some plan to eliminate the first cost of the sign to the consumer has begun to encourage the sign business. One "free sign" proposition is for the company to install the sign, the customer agreeing to use a specified amount of electricity per month for a certain length of time. Another proposition is for the company to charge a flat weekly or monthly rate for the use of the sign and the electricity. Some central station managers prefer a special rate for electricity for signs to a "free sign" proposition. It was stated, however, that an electric sign owned and controlled by a merchant brings in approximately one-half as much income as a sign installed on any good "free" proposition, and yet it requires the same central station capacity. A certain number of companies have experimented with the plan of allowing the portion of the flat rate above the cost of the electricity to apply toward the payment for the sign until the sign becomes the property of the customer. Another popular method is for the lighting company to have the sign billed through it, and thereby to give the purchaser the benefit of the dealer's discount. Still other methods are to connect or hang the sign without cost or at the lowest cost for materials and labor.

DISCUSSION.

Mr. Gilchrist, in answer to some questions as to the system of patrol for turning signs on and off, said that in the congested part of Chicago one patrolman can switch on and off 100 signs with ease. Such men were paid about $60 per month, so that the cost of the patrol ran about 60 cents per sign per month. In the outlying districts it was the uniform practice to place signs on a meter basis in which the customer guaranteed a certain amount of income monthly and could switch on and off his own sign.

Mr. Percy Ingalls, of Newark, N. J., said in the Public Service Corporation territory there were 636 free signs, which had been placed entirely on the meter basis, charging the regular rates for energy, and requiring a minimum bill varying from $5 to $15 per month, depending on the size of the sign. For the ordinary 24-lamp sign they require a minimum of $5 per month. The revenue from these signs increases very rapidly, being now at the rate of $60,000 a year from 600 signs. The company had advertised for this business and put special solicitors on it. Under the meter system with minimum bill, they found that many customers paid what amounted to a very high kw-hour rate by virtue of not using current up to the minimum bill. He did not pretend to say that this was good practice. They had practically decided to adopt the patrol system and put all signs on a flat rate.

Mr. W. W. Lloyd, of Chicago, said the sign business in Chicago brought in a revenue of approximately $300,000 per year. There were over 3,000 signs on the system. The past month nine solicitors contracted for 162 signs. These contracts were on a two-year basis and the net revenue from the month's business would amount to $26,700. These solicitors are specially trained for their work. They are paid a small commission, at the rate of $2.50 per sign, in addition to their regular salaries.

PROFITABLE COMMERCIAL CO-OPERATION.

The paper by Mr. J. R. Crouse gave an outline of the Co-operative Electrical Development Association which has been projected as the medium through which a more extended community of interest among the different branches in the electrical trade may be obtained. The objects of the association include the promotion of increased use of electricity by the public for light, heat and power against all competitors for like services, as an end in itself, and as a means to the increased demand for electrical apparatus and supplies and the co-operative planning and execution of various means and methods effective to this end, and the establishment of co-operative relations both moral and financial among the different electrical interests, from the manufacturer to the consumer, to the end that each may contribute in some measure toward bringing about the results desired in common by all.

The manufacturers with whom all the means of electrical service originate are on that account and by reason of financial strength and the conditions under which manufacturing is at present organized, the logical interests to initiate this movement. They have it in their power at almost a negligible tax upon their revenue to set the example of broad-gauged and effective co-operative work which will at the same time meet with the most cordial indorsement and co-operation at the hands of the entire distributing and purchasing trade, and a logical conclusion of which is that every well defined interest in the industry will eventually participate financially in the work in reasonable proportion to the benefits derived. Manufacturers and distributers are now spending millions of dollars for the sale of essentially similar electrical apparatus and supplies against each other, the new business-building force of which it must be conceded is to a considerable degree dissipated in competition for trade which either already exists or which develops from a certain natural growth of the business. To a very considerable degree its success will be measured in the terms of its practical assistance to central stations and this assistance in turn will depend upon the degree in which effective co-operation is given to the new Association by the central stations and other branches of the distributing trade.

DISCUSSION.

President Blood said that Mr. Crouse was father of the idea of profitable commercial co-operation. One of his children came to us in the form of the committee which was appointed to co-operate with the manufacturers on advertising. The committee was composed of Mr. Paul Spencer, Mr. John F. Gilchrist and Mr. J. E. Montague. Mr. Spencer not being present, Mr. Gilchrist read the report. At the close of this report it was voted to appoint another similar committee for the next year.

Mr. Converse D. Marsh said that the Association itself had had a very practical demonstration of what advertising could accomplish for it. Mr. Doherty told the members of the executive committee that he could secure 250 new members during a certain year, which seemed impossible, as the rate of growth had been comparatively small before that. That year was finished up with 263 new members. He had seen many plans for getting money through publicity, but never saw one as comprehensive as Mr. Crouse had presented.

Mr. John F. Gilchrist said there was undoubtedly some dis-

position on the part of central station men to shrug their shoulders and say that this co-operation scheme was one devised by the manufacturers to sell their goods. It is, but it is a good, clean scheme. While the manufacturer will undoubtedly profit, central stations will make a hundred dollars for every dollar the manufacturers make.

GROUNDING SECONDARY CIRCUITS.

A paper was read by Mr. Sidney Hosmer giving the following account of the practice of the Boston Edison Electric Illuminating Company with respect to grounding the secondary of alternating-current circuits.

In the spring of 1905 the Edison Electric Illuminating Company of Boston, as a result of an increasing number of accidents and the removal of the bar previously maintained by the insurance interests, determined upon the policy of grounding all alternating-current circuits, at that time numbering about 5,500, scattered over fifteen towns. After some deliberation as to method, it was thought that the best and cheapest way to do this would be by connecting each circuit with the nearest water pipe in the building.

This arrangement made necessary the obtaining of permission from the householder—a rather laborious process—and, as the insurance interests thought best to require the wire run on the outside of buildings, it did not add to the appearance of the houses. Before undertaking it, therefore, the effort was made to ground in the street at the transformer. A large number of trials of this method over the entire territory demonstrated that it would be impossible to get satisfactory grounds at any reasonable expense. These trials were made by digging and by driving, going as far down as 40 ft. It was then decided that all circuits where less than twenty were supplied from one transformer or main should be grounded individually on water pipes and larger groups should be left for further investigation and trial of street ground. The requirements for street grounds were that each should be tested and should be able to blow a six-ampere fuse on the 115 volts. Up to the present time it has been found that it was impossible to obtain these grounds except in a few places, and it will be necessary to abandon this method entirely.

Having arrived at the conclusion that individual circuits should be grounded, various conferences were held with the insurance interests and with the municipal authorities having jurisdiction, and certain detail rules were formulated by some of them as to the treatment of the ground wire in buildings.

In general, these rules required the following:

(1) All installations to be tested and if below insulation requirements of the underwriters' general rules they could not be grounded nor could any installation fed from same transformer or main. (This requirement was afterward modified to call for a minimum insulation of 10,000 ohms.)

(2) Wire to be treated as an electric light wire, not less than No. 4, and to be run on outside of building as much as possible.

(3) A special clamp for water pipe was prescribed.

Several contractors were then sent out with instructions to install twelve grounds under these rules and submit a flat price per ground for covering all the territory, and two were afterward awarded the contract. Next, the tenant or owner of each building in which a ground was required was visited and permission obtained for doing the work. A certain amount of difficulty was encountered in this stage of the work, but a comparatively small percentage of refusals were received. Where the customer did refuse, he was required to sign a release, accepting the responsibility himself. On new business coming on to the lines, the installation of the ground wire by the building owner is made one of the requirements for service, unless he is willing to sign a release.

In some of the towns the water departments, and in one case a private water company, offered objection. The water departments were in all cases reasonable and ready to investigate and be convinced that it brought no risk to them and they all have been satisfied. The water company refused to discuss, investigate, or argue the matter at all, ordered all grounds removed, and notified its consumers that after January 1, 1906, water service would be discontinued to any house where a ground wire was attached. This town was very nearly all grounded before the water company took that position. About 25 per cent of the consumers have removed their grounds, signing a release to the Edison company, but no action has been taken against the others by the water company.

The insulation test requirement has been the one thing that has caused the most trouble, as not only is there the labor of making the test, but one bad installation will, of course, prevent grounding all installations fed from the same source.

Practically all the services are grounded now except those held up by low insulation, and these are in the hands of the insurance underwriters to compel correction.

DISCUSSION.

Mr. P. H. Bartlett, of Philadelphia, said they had done a considerable amount of preliminary work in the same direction in Philadelphia, and were now taking the matter up with the insurance interests. The greatest trouble he anticipated was getting customers' installations up to the installation requirements. He asked whether any difficulty was experienced in obtaining the modifications of the requirements mentioned calling for a minimum installation resistance of only 10,000 ohms, and also what percentage of the installation did not come up to these modified requirements. He noted that in the supplement of the National Code issued in April of this year the requirements for grounding had been altered and now cover about such a system as the Boston company has installed.

No one being present from Boston to answer these questions, Mr. W. T. Morrison, of New York, was asked for the experience in that city. He said that secondary circuits had been grounded by two methods, one being the plate method, which was used very largely, and the other a bunching of copper wires. A year ago, having noted that a verdict had been rendered against an electric company in Philadelphia which allowed dangerous current to get on a lamp socket and kill a person, and realizing the necessity of protecting the public, he had made a series of tests on every ground in a large system covering about 75 miles of pole-line and carrying about 4,000 kw. The result showed that the grounds made in the manner usually used by electric light companies were very poor. In fact many of the grounds were 100 ohms or over. This meant that if a current of 20 amperes flowed which did not blow the fuse, it would maintain a voltage of 2,000 volts into the customer's premises. Realizing the necessity of getting something to relieve the situation at once, he made up a map of a system by which all the neutrals would be connected to a common grounded neutral, extending all over the system. This neutral would be grounded heavily at the station to a large 18-inch water main coming from the salt water. They found that the cost of such a system would be much less than that of grounding to customers' service water pipes in the manner outlined in the paper. That might be due partly to the fact that in his district there are a large number of customers on secondary mains, and the neutrals were extended over most of the pole-line. The cost of continuous grounded neutrals he figures at $25 for 1,500 services, which is much less than the cost outlined in the paper, which he understood was approximately $8 per connection. One advantage of a system of maintaining the neutrals in this manner was that it kept any accident that might occur entirely on the company's own pole-lines. Some cases were on record where the trolley feeder had become grounded on the neutral of the lighting systems and carried a large amount of current into the customer's premises. For this reason it seemed preferable to keep all the grounding on the company's property. After laying out the grounds in the district which he had already described, he laid out another system along the same lines for a further outlying district, namely, the Yonkers Electric Light & Power Company, where the kw capacity was much less, being about 800, as compared to 4,000 for the district first mentioned. At first sight he thought it might be impossible to carry out such a system, as naturally there would not be as many neutral wires carried on the poles. After looking over the situation he found that for about $3,000, 95 per cent of the transformers could be grouped on such a neutral wire. The tests which he had made to determine the resistance of the plate and wire bundle grounds already mentioned showed that these grounds had from 30 to 470 ohms resistance

per ground. To secure a good ground he had tried taking a plate 3 feet long by 2 feet wide of solid copper, burying it near the river with a barrel of coke on top of the plate and a barrel of coke underneath. He found 30 or 40 volts would exist between the plate and the ground, without blowing a 6-ampere fuse.

President Blood said that Mr. Hosmer had made a number of tests which showed that in certain soils the resistance of grounds installed according to the National Code rules runs up into the hundreds of ohms in nearly every case. He also last week had seen other tests made by Prof. Puffer, of the Massachusetts Institute of Technology, showing the same thing. It was the opinion of both of these gentlemen that the only really safe ground was that secured by connecting directly to the water pipes.

Mr. S. J. Rhodes, of New York, asked Mr. Partridge if he preferred to put all the lines on one pole rather than putting the lines of different companies on their own poles.

Mr. Partridge answered that on a street where there were three or four kinds of service it was impossible to maintain independent rights of way. From the standpoint of the public one set of poles is enough, and the companies should meet the proposition from the standpoint of the public and attempt to set as few poles as possible on the streets.

Answering a question from Mr. McCabe he said that he did not think there was a satisfactory strain insulator for guy wires for 6,600 volts

In answer to a question as to the life of creosoted cross arms, Mr. E. F. McCabe said he found a creosoted arm would last no longer than one not creosoted. He found white pine lasted as long as yellow pine, and in some cases longer.

Mr. W. F. Wells, of New York City, asked Mr. Partridge how he found a permanent and effectual ground where the poles were set in sandy soil. He had tried many things in Brooklyn, but could not find anything to do that.

Mr. J. T. Hutchinson, of Rochester, N. Y., used street railway tracks as a ground in that city. Where they cannot get a track ground they ground the water pipes.

Mr. W. T. Morrison asked how he prevented railway current from flowing over the ground neutrals when they were grounded in several places, and disturbing the voltage on the lighting system. Mr. Hutchinson said that this was taken care of by a careful survey of the railway system.

FIRE HAZARD OF ELECTRICITY.

The report of the committee on the fire hazard of electricity gave an excellent showing of the relation of this hazard to that of other agencies supplying the same general class of service. As a basis for analysis use is made of the official report of the Fire Department of the City of New York for the years 1902, 1903, 1904 and 1905. In all Manhattan Island and the Bronx, only 361 fires have been caused by electricity during these four years; during this time candles caused 1,248, gas 2,049, and oil lamps, 826 fires. Electricity caused a little less than one and one-quarter per cent of the fires, and a little more than one per cent of the total loss by fire.

The excellent showing is doubtless due in a great measure to the careful supervision of this subject by the insurance interests and the municipal authorities. It is fair to assume that the use of electricity as an illuminant now exceeds that of all other mediums; and the careful supervision of installations and the study of the causes of fires started by electricity during the last ten years have given us a knowledge of the means required to minimize such fires. This requires good workmanship and careful installation; but it would seem that the extreme measures sometimes imposed are not necessary. The National Electric Code is now generally accepted as the standard rules for the installation of electric wires, and gives very satisfactory methods of procedure in practically all cases. Fortunately these rules are generally accepted throughout the country, and are, in by far the majority of cases, reasonably interpreted by the inspectors. Occasionally instances are found where extreme requirements are imposed on account of an interpretation of the rules which was clearly never intended by the framers, or by the setting up of special requirements which do not exist.

On account of the very excellent showing of electricity as a fire hazard, attention is called to these extreme requirements as being unnecessarily harsh and causing needless expense to the manufacturer, central station man and the consumer, and making those unfamiliar with the subject unduly apprehensive of fires from electrical causes.

DISCUSSION.

After this report President Blood introduced Mr. W. H. Merrill, Jr., of Chicago, secretary of the Underwriters' Laboratories, who was sent to the convention as representative of the National Board of Underwriters. After calling attention to some details in the report which were slightly misleading, he said that the important point, however, was not the few facts in the report, but it was rather the fact that the association had appointed a committee on the fire hazard of electricity, and that the association recognized that such hazard exists. He was greatly interested in the allusion made in the president's opening address to the employment by the association of an expert to look into the subject of fire hazard, and serve the association's interests in various sections of the country where inspectors have from time to time, largely through ignorance, given interpretations of rules which were not in accordance with the ideas of the framers of these rules. A competent man in that capacity would prove valuable not only for the duties planned for him, but also to bring home to the association truthfully and completely the extent to which electricity for lighting is permitted, through carelessness and ignorance, to become a factor in the destruction of property. All admitted that electricity was the best and safest form of energy used for the production of artificial light. Until the art had been brought to a state where artificial light could be produced without heat he asked the helpful co-operation of the association in the work insurance interests are doing to determine exactly the extent to which this hazard is a factor and to work together with them for the common good.

The president then introduced the chairman of the National Convention on Electrical Rules, Mr. C. J. H. Woodbury, of Boston. He referred to the proneness of newspapers to ascribe causes of fire to electricity. For example, in San Francisco he had recently learned that one of the first effects of the earthquake was to disturb the central stations so that wires were not alive, that the fires were largely due to the shattering of chimneys at a time when boilers were being fired up for running elevators and other work. He thought that if the number of electric lamps used, together with the number of kerosene lamps, and the number of gas jets could have been tabulated in such a report, the results would have been more in favor of electric lamps than in the report of the committee. As an example of how safely electricity could be applied for illumination he could cite the case of the factory mill insurance companies engaged in insurance, largely on cotton mills—a most hazardous class. During a period of 14 years there was not a known fire in all this $100,000,000 worth of property which was ascribed to the electric lamp. At the same time electric signaling, fire alarms and telephones had been of inestimable benefit in keeping down fire losses.

MAINTENANCE OF WATT-HOUR METERS.

In a paper dealing with the maintenance and calibration of service meters, Mr. William Bradshaw emphasized some essential points in the use of secondary and primary standards which are not generally recognized. The most important and vital work of the maintenance bureau and laboratory of the central station is the proper use and calibration of the secondary standards and the care and use of the primary standard.

The method of calibrating service meters by means of the rotary standard is so simple that many make the mistake of thinking that all that is necessary to make the proper check on the meter under test is to compare its speed with the standard. If the service meter and standard are of the same type and capacity, a comparison of speeds indicates directly the accuracy of the meter under test; however, if of different types they will have different characteristics, and hence give different registration for the same loads or variations from normal of the voltage, frequency or temperature.

Corrections must be made in the reading taken during test for this different percentage registration or serious error will be made in setting the meter under test.

The construction of the secondary standard will also affect

the meter calibration. The standard should have several different capacities of series coils; their normal capacity corresponding to the normal capacities of the service meters in use. If these capacities do not agree there is another chance of error being made in calibrating the meter. A test should never be made with the meters so arranged as to give nearly full load on the standard and light load on the meter being tested. Each type of watt-hour meter has a load curve that is not only different, but whose general shape is not a straight line. Hence the calibration of a meter by a load at one point of the curve and a reading on the standard at another point of the curve may mean an error in the setting of from 0.5 to 1 per cent, or even more. In selecting a secondary standard, choice should be made of the meter which shows the best average performance for both load, voltage and frequency, and the limits of variation should not be greater than specified for service meters.

The primary standard determines the accuracy of the entire work of the calibration bureau, and its reliability and permanency are of vast importance. The service meters have an inherent range of 75 times its smallest calibrated reading and the primary standards must cover the range limits of the entire line of service meters in use by the station. The manufacturer or some standardizing laboratory should calibrate and maintain the primary standard.

DISCUSSION.

The discussion on this paper was taken part in by Messrs. J. F. Becker and Edward Weston, and is of a nature which does not permit of abstract.

CONTROL OF ALTERNATING-CURRENT ELEVATORS.

Mr. W. N. Dickinson, Jr., presented a paper on alternating-current elevators, which outlined the requirements of successful control devices for such equipments. In elevator work the most important consideration is safety, and upon this the certainty with which the maximum speed may be limited and the elevator brought to rest has a direct bearing. An induction motor has practically the same characteristics as the direct-current shunt motor and, with all resistance cut out of both primary and secondary circuits, the speed of the induction motor is limited quite as well by the number of cycles on the circuit as the speed of the direct-current motor is limited by the line voltage. In the event of the line circuit being broken, however, the comparison ceases. Under such conditions the direct-current motor could retain a speed-regulating effect, while the speed of the induction motor would be limited only by the relation existing between the driving force and the mechanical friction opposing it. With highly efficient gearing and mechanical control, the failure of the current with the machine in operation or the lifting of the brake with no current on the line would prove a source of danger. Safety, as well as convenience, demands that an alternating-current magnet control should be available if higher speed or more efficient work are to be undertaken. The author stated that the problem of magnetic control has practically been solved. Something over a year ago a multiphase magnetic control was set up and operated, and its action was positive. Chattering was obviated by the use of four-pole magnets acting on circular armatures. For a two-phase circuit, two U magnets were set at right angles to each other, each having its pole tips the same relative distance from the common armature. Each magnet was wound for a separate phase and its strength varied with the alternations of the current. As one magnet was of maximum strength when the other was zero, and vice versa, and both acted on the same armature, the pull on the latter was constant and as this armature carried the moving contact of the control, the contact it made was firm and constant. Furthermore, its attractive action was instantaneous and its release prompt. Magnets of this type may be made as large as desired, and are available for controls or for brake mechanisms.

For ordinary controls, a single-phase magnet of the solenoid type has been developed, which is simpler in construction and wiring, and lends itself more readily to the requirements of control. Owing to the single-phase winding, the pull on the solenoid core is not steady, and if the contact were secured directly to this core it would chatter and the electrical contact would be uncertain. To avoid this, a movable contact in the form of a copper disc is sleeved over an extension of the core and supported by a light spring. The energizing of the solenoid coil raises the core and completes the circuit through the movable and stationary contacts. During the time the current is passing through the coil, the core has a longitudinal vibratory motion, due to the alternating nature of the current. The height at which contact occurs and the pressure of the spring are so adjusted that even when the core is at the lowest point of this movement, a firm electrical contact is maintained. This spring principle has also been applied to horizontal magnets with hinged armatures, but the vertical solenoid is the simpler type.

DISCUSSION.

Mr. P. D. Wagoner, of Schenectady, said that there are numerous cases where the advantage of being able to use direct current would more than offset the power equivalent to one or two incandescent lamps. He felt it was entirely possible to apply rectifiers to this service without the use of any storage battery whatever. He had seen a trolley car propelled by current from the mercury arc rectifier. He did not believe that the current supplied to maintain the mercury arc in a rectifier used in connection with elevators usually represented a loss which was prohibitive. Mr. Wagoner said it was possible to maintain the arc during the period referred to by Mr. Dickinson with a loss of power not exceeding 100 watts.

Mr. Dickinson said he was glad to hear that it was considered possible to run elevators through the means of the mercury arc rectifier alone. He had gained the idea that 600 watts was required to maintain the arc in the rectifier tube.

Mr. W. A. Layman, of St. Louis, said he thought that the greatest difficulty in the alternating current elevator situation had been the fact that some of the elevator companies had not recognized that the central station man had anything to do with the question, and his wishes as to elevator development had not been considered to any great extent. To illustrate how far some of the elevator men are from contact with the central station situation he cited an interview with one of the most prominent elevator men in the country, who made the emphatic statement that he was not interested in a single-phase elevator motor, as there was no demand for any such service. Mr. Layman said that his company had been proceeding slowly in the introduction of this motor because is wished to demonstrate what the equipment could do. They had put out 35 equipments and had been watching them to see the results. Inquiries had come in by the score from central station people for single-phase elevators. Such inquiries had been directed to the elevator people. He thought it would not be long now before any central station in any part of the country could get a single-phase elevator equipment if it insisted upon it. As to single-phase versus polyphase elevator motors he thought the same principle held there as in the ordinary power service. There is an engineering dividing line between the polyphase motor and the single-phase motor for constant speed service, and there is the same dividing line in elevator equipment. The central station engineer will determine where he wants to have polyphase service, not only for constant speed motors, but for elevator motors, and also where he wants single-phase service. After he has decided that question the installation of the equipment is a simple proposition.

AUTOMATIC SWITCHBOARD DEVICES.

In a paper on "Modern Switchboard Practice with Particular Reference to Automatic Devices," Mr. F. M. Hewlett gave a brief description of the various automatic switchboard devices and discussed the application of these devices. In the discussion four representative systems were considered, as follows:

Case No. 1—For villages and small cities, with a simple 2,300-volt, 60-cycle distribution.

Case No. 2—For medium-size cities, with 2,300-volt, 60-cycle distribution.

Case No. 3—For large cities, with 4,150-2,300-volt, 60-cycle, four-wire, three-phase distribution.

Case No. 4—For very large cities, with 6,600 to 13,200-volt, 25 to 60-cycle underground transmission to sub-stations and direct-current or alternating-current distribution from the sub-stations.

Under the different cases it is necessary to consider the different circuits separately. For instance, if two circuits from the same system feed different classes of service it may be advisable to treat each circuit differently as to automatic protection.

Under case No. 1 the conditions could be well met by the use of plug switches and fuses. Automatic oil switches could also be used on the multiple feeder circuits in place of plug switches and fuses. Instantaneous trip coils would be used, as the extra cost of time limit relays would not be warranted. The generators are not ordinarily provided with automatic protection.

Case No. 2 represents a large number of systems with slight modification. Under this case overhead lines would probably be used for the circuit, though in some cities there may be a partial underground distribution. Fuses could be used satisfactorily, but automatic switches allow the circuit to be cut in more quickly and would generally be recommended except on the smaller plants. Under any conditions fuses would be used for protecting the series arc transformers.

Where automatic switches are used on the smaller plants they should have instantaneous trip; in the larger plants inverse time limit relays would be advisable. The generator switches would be non-automatic, it being found in practice that more inconvenience arises from automatic protection than from non-automatic switches.

In a plant of, say, 1,500 kw and above it is good practice to mount the oil switches away from the board, operating the switches by means of suitable levers and cranks. When the station capacity reaches 3,000 or 4,000 kw it is advisable to place the switches in masonry compartments and in some cases operate the switches electrically.

Under case No. 3 there may be various modifications, but a system with a main generating station at the outskirts of the city with an alternating-current-direct-current sub-station in the business district was chosen as typical. In a system of this character, automatic oil switches are invariably used on the outgoing circuits and inverse time limit relays are recommended except for the sub-station feeders, which should have definite time relays. If automatic switches are provided with the generators a reverse-current definite time limit relay is probably the best form of protection. A better arrangement would be, however, to omit the trip coils from the switches and let the relay simply light a lamp or ring a bell.

The incoming lines at the sub-station should have inverse-time relays. This, in combination with the definite time relays in the main station, in case of a short-circuit between stations would open up both of the line switches at the sub-station and the switch of the short-circuited feeder only in the main stations, thereby indicating which feeder was in trouble.

On a severe short-circuit, the synchronous machines in the sub-station would possibly feed back into the short-circuited line before the machine switches could open and cause more current to flow in the short-circuited line than in the other line from the main station. On account of the inverse time element of the line relays, the relay in the short-circuited line would operate more quickly than the relay in the other line, relieving the system. As the relays in the synchronous machines are preferably of the instantaneous type, the above case would not often arise. If three lines were installed from main to sub-station, the inverse time relays would act selectively on short circuit, and only the short-circuited line switches would open.

On the direct-current side of the rotary converters or motor generator sets, reverse-current relays are usually provided to trip the circuit-breaker of the machine in trouble, leaving the other machines in circuit.

Case No. 4 represents the largest central stations feeding a number of sub-stations, all distribution to consumers being from the sub-stations, such distribution being either direct or alternating-current and sometimes both.

The voltage of this class of systems is from 6,600 to 13,000, and the amount of power is large, making it necessary to use electrically-controlled switches, mounting the switches and 'bus-bars in masonry compartments. The usual practice is to provide two sets of 'bus-bars, each set being sectionalized at least once. In some cases the machines are all run in parallel on one set of 'bus-bars, using the second set only for emergency. In other cases some of the generators and feeders are connected to one set and others to the other set. It is obvious that while the best load factor and efficiency may not be obtained, liability to a complete shut-down is eliminated by the latter method, and in case of a short-circuit there is not so much power feeding in parallel and consequently less trouble is likely to arise.

As to automatic protection, practice varies somewhat. Either non-automatic switches or automatic switches with reverse-current time-limit relays are used on the generators. On feeders, the bellows-type inverse time-limit relay has been used largely with excellent results. In a system with three or more circuits to each sub-station, or with only two to each sub-station, if tie lines are used between stations, selective action can be obtained by the exclusive use of inverse time-limit relays properly adjusted, or with inverse time-limit relays on the sub-station end of lines and definite time-limit relays on the generating station end.

With three lines feeding a sub-station, direct from generating station or partly through another sub-station, a short-circuit on one line causes the other two lines to feed in multiple into the short-circuited line, giving the latter twice as much current as either of the other lines. The relay of the short-circuited line would operate more quickly than the other relays, opening the circuit and relieving system. (In an extreme case of short-circuit it is possible that all the relays in the sub-station may operate, due to the very heavy rush of current, which might eliminate the time feature on the relay.) The relays at the generating station end, if either of definite time-limit type or if of the inverse type and set for a longer time than the sub-station relays, will not operate until after the sub-station relay, and then only the relay of the line in trouble will operate. Especially in the case of a system with considerable synchronous apparatus, the matter of the setting of the relays should be carefully studied and experiments made to determine the proper adjustment.

DISCUSSION.

In discussion of this paper, Mr. H. L. Wallou, of Cleveland, thought that the use of the time limit relay on very heavy feeders might be all right, but that it was not suited to comparatively small feeders. For small feeders he preferred an instantaneous opening relay set for about 90 amperes, for example, on a 75 ampere feeder.

MOTOR-CONTROLLING DEVICES.

A paper by Mr. H. D. James gave a discussion of the various types of controllers now employed with both direct and alternating-current motors. In addition to the mechanical devices which may be used for varying the speed, and both mechanical and electrical devices which may be used for braking, descriptions were given of the general features of rheostatic and variable-voltage speed controllers and of devices for changing the motor characteristic, such as those used in varying the field strength of a direct-current motor or in changing the number of poles of an alternating-current machine.

THE DESIGN OF HYDRO-ELECTRIC INSTALLATIONS.

The paper by Mr. E. F. Cassel on the design and manufacture of hydro-electric installations as a whole was a plea for greater co-operation between the designers of turbines, the designers of generators and the consulting and operating engineers. It is extremely desirable to take into consideration a great many more points than merely trying to produce a turbine or a generator which might each fully comply with specifications, but still not be as suitable for the work to be performed or as economical in installations as a proper modification arrived at when the installation is considered as a whole.

Manufacturers of turbines are interested in selling turbines and are not interested in electrical specifications or requirements. Manufacturers of generators are not interested in the difficulties of the turbine manufacturers. If the plant as a whole fails to produce the desired results, each has an opening to shift responsibility, whereas, if the manufacturer were equally interested with the consulting engineer and the purchaser in the actual results of the installation as a whole, the results achieved would

be easily determined and the responsibility fixed. Instead of usurping any of the functions of the consulting engineer, such a manufacturer should be of invaluable assistance, both in determining the type of plant best suited for the installation as well as to the details of manufacture.

If there is one element in a hydro-electric installation which must be considered in connection with all the other parts of the generating station, and which should be designed and furnished by the turbine manufacturer, it is the governor. The rotating parts of the generator and turbine, the relief valve, the penstock and draft tube, are as much a part of the governor as the fly balls themselves; yet, in spite of this, we find contracts let to one manufacturer for the turbine, to another for the generator, to another for the governor, and sometimes to another for the relief valves. If the plant in operation is not subjected to the severe conditions provided for in the specifications, the governing is said to be satisfactory. If it fails there is always someone else to blame. Had the plant been furnished by one manufacturer as a whole, all the elements connected with the question of governing would naturally have received proper consideration in the design, for the reason that the manufacturer's guarantees would be judged by actual results in operation and not by determining whether or not the governor furnished so many foot-pounds in so many seconds. What applies to determining the guarantee of the manufacturer as to governing also applies to the question of efficiency. Were the entire installation designed, manufactured and guaranteed as a whole, the difficulty of determining results would be practically eliminated. There would be no further necessity for determining the efficiencies of the generator, turbine, exciter and exciter turbine separately, with the necessary allowance for thrust bearing friction, governor drives, etc., as at present. The same efficiency would be required, but would readily be measured by actual electrical output, and once determined there would be no shifting of responsibility in case of failure.

The writer expressed the opinion that the personal interest which the manufacturers of a hydro-electric installation as a whole would have in the results actually achieved by the installation when in operation, induces a stronger tendency toward perfection in practice than the present method of manufacturing material in accordance with specifications, but with no responsibility as to whether or not such specifications may be right or wrong.

CO-OPERATIVE ELECTRICAL DEVELOPMENT ASSOCIATION.

The committee appointed to co-operate with the manufacturers' advertising committee, consisting of Messrs. Paul Spencer, J. F. Gilchrist and J. E. Montague, reported that the plan of the manufacturers' committee has grown so as to include the incorporation of an association known as the Co-operative Electrical Development Association, to be made up initially of a membership of manufacturers of electrical apparatus and supplies, and to have for its object the promotion of the increased and more extended use of electricity by the public. The directors and officers of this association are to be chosen by the representatives of the manufacturers who make up the membership, but there is provision for advisory directors from allied interests, such as the National Electric Light Association. The work of this association promises to be of great benefit to the development of the commercial side of the electrical industry and therefore to the central station interests. It will provide a permanent organization whose formation and whose management will be in the hands of representatives in every interest of the trade. Such an association can work along many helpful lines. This permanent organization should serve as a clearing house for the most successful new business-getting methods.

The association will also be able to stimulate public interest in the use of electricity by judicious advertising. This work being undertaken by a general body can be made helpful along lines which the specialized interests, either of manufacturers or of any particular station, cannot now reach. For example, good work can be done by supplying reading matter to the newspapers and possibly by advertising in the popular monthly and weekly magazines, and in this way bringing before the public at large the manifold uses and advantages of electricity. Such advertising can also be carried on in trade papers and journals that are more or less indirectly connected with the application of electricity, but which are now almost devoid of any reference to the subject. Such advertising work carried on in builders' and architects' journals, with reading articles describing the uses of electricity, should be of great value in sowing seed that will bring forth a bountiful harvest to the central stations. The proposed association is an organization having for its object the common good, and its efforts should be received in the broad-minded spirit in which they are put forth. The success of the scheme lies very largely in the hands of the central station interests and the attitude which they assume toward it will undoubtedly be the determining factor in influencing the manufacturers' committee to carry out in full the work which has been planned. The committee recommended that a committee of the National Electric Light Association be again appointed in the coming year to assist the Co-operative Electrical Development Association in the work which it has planned to do.

Exhibits at the N. E. L. A. Convention.

FOR the purposes of the exhibition of electrical apparatus the National Electric Light Association retained the whole of the boardwalk end of Young's Pier, and laid out an elaborate scheme on the plan of a hollow square. The exhibits lined three sides of the hall in a double row enclosing a central space occupied by the bandstand and 1,000 rocking chairs, which were freely at the disposal of the delegates and their friends. Here the band gave three concerts daily and, thanks to the decorations, the lights, and the moving crowds, the exhibit had a most attractive appearance, so much so that, it is said, that no visitor to Atlantic City during the convention week failed to look in at Young's Pier and see what was going on. This was exactly the object aimed at by the Association, the idea being that the exhibit would not only serve to put manufacturers and central station men in closer contact, but would have a distinctly educational aspect. Long before the show opened all the space reserved had been taken up, and the exhibits overflowed beyond the main hall into the theatre lobby, and the north and south wings of the pier.

In order to secure and enhance the decorative effect, the booths were made as nearly uniform as possible. The entrance, on each side of the ticket office, was flanked by the large and handsome booths of the National Electric Light Association and of the Electrical World. These booths were draped in green and red, with white and gold standards and signs, illuminated, and the general color scheme of the exhibits was that of light green, white and gold. All the booths laid out by the Association contractor, Mr. Singer, were uniform in size, decoration, furniture and general appearance, and the effect was most harmonious. This scheme of decoration applied more particularly to the booths in the background along each side of the pier. The larger spaces in the foreground, such as those of the Westinghouse, Allis-Chalmers, General Electric, Southern Exchange, Metropolitan Engineering, and Johns-Manville, had special designs and decorations of their own. Wherever possible, palms and other plants were introduced as accessories, and in the case of the Westinghouse exhibit, the largest of all, the general effect was that of two or three panels with green bamboo roll curtains as a rear "drop." The booth of the Allis-Chalmers Company had also a prevalent note of deep green, sharply relieved by drapings of red, white and blue, while the General Electric Co. went to the other extreme and secured an extremely rich effect by the severe simplicity of the green and white framework set in palms and overhung by large metallized filament and tantalum lamps in holophane fixtures. In several places the general effect was enhanced by the decorative material furnished by the central station companies themselves, including a large number of valuable paintings and drawings. The ceiling of the hall had hundreds of small lamps as a permanent part of the decorative effect, and when to these were added at night the hundreds of special lamps employed in the exhibits and the scores of large and brilliant decorative signs, as well as two Excello flaming arcs, the effect was very bright and effectively spectacular.

The exhibitors as a whole appeared to be very much pleased, not only at the moderation of the charges for space, but at the general setting and at the results achieved. They certainly were never before enabled to reach so many central station managers at one time and thus make new customers, or to introduce their novelties to old patrons. It is needless to say that the features particularly attractive were the new flaming arc lamps, in regard to which the most intense curiosity and interest was shown. The Moore exhibit, with a continuous tube encircling the whole of the large theatre lobby, was also incessantly a center of attraction, and while to the expert it was a matter of technical study, it was to the laymen present a matter that appeared almost impossible of explanation,—the average idea being, so far as could be ascertained, that liquid light was being pumped into the glass tube from some hidden source and was in circulation inside the glass. As usual, a number of souvenirs were distributed by the exhibitors, some of them quite handsome and costly, but as a general thing the exhibitors confined their hospitality to the hotels and restaurants, and devoted a large part of their energies to the distribution of trade literature. A gratifying amount of interest was displayed in the electric cooking and heating apparatus, which even to-day is novel to many central station men, and it is understood that very few of the exhibits of this character were taken home by the exhibitors, purchasers being found for them *in situ* in almost every instance. Below will be found brief notes of the exhibits made.

THE H. B. CAMP CO. was represented by S. A. Douglas and C. C. Baird.

BANNER LAMPS.—The interests of Banner lamps were ably represented by Mr. N. L. Norris.

MR. E. J. WILSON, secretary-treasurer Eastern Carbon Works, Jersey City, was in attendance.

THE B. S. BARNARD CO., New York, had Manager George A. Nisbet looking after its interests.

THE ALBERGER CONDENSER COMPANY, of New York, was represented by President Louis R. Alberger.

MR. J. W. BROOKS, sales manager of Pass & Seymour, Inc., Solvay, N. Y., was very much in evidence.

THE PHOENIX GLASS COMPANY was represented by A. H. Patterson, vice-president, and E. P. Ebberts, secretary-treasurer.

MR. T. H. BRADY, of New Britain, Conn., was in attendance. He has been present at every one of the twenty-nine conventions.

THE HIGH-TENSION ELECTRICAL SPECIALTY CO., Newton, Mass., had Mr. W. E. Holmes speaking for the product of the company.

E. O. LUNDIN, president of the Lundin Electric & Machine Company, Boston, was present in the interests of its many lighting specialties.

THE "SARCO CO.", New York, was represented by Ralph A. Schoenberg, working industriously in the interests of the Sarco pendant switch and Sarco two-light reflector, both of which he succeeded in installing in nearly every booth at the convention.

THE D. & W. FUSE COMPANY, Providence, R. I., was represented by W. S. Sisson. While no formal exhibit was made, sample cards of Deltabeston magnet wire and a souvenir pencil in the shape of a fuse were distributed, and were in great demand.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, Ind., exhibited a number of its latest direct-current meters, the exhibit being in charge of William H. Sinks. Quite a display of 500-volt power meters was in evidence to show the latest features for this particular application to withstand the action of lightning.

THE SOUTHERN EXCHANGE COMPANY, of New York City, and Maxton, N. C., was represented at the convention by Mr. E. G. Chamberlin, president, and Mr. Walter E. Mitchell, sales manager. They had a very attractive booth at the left of the main entrance with decorations of white and gold. Their exhibit consisted of octagonal and square poles, cross arms, insulator pins and insulators. The material was shown in the form of regular line construction and elicited much admiration. This company reported many orders from the convention and a very prosperous year thus far.

NIAGARA TACHOMETER AND INSTRUMENT COMPANY, Niagara Falls, N. Y., had an attractive booth in which to exhibit its complete line of recording and indicating tachometers and tachographs. These instruments created a great deal of interest among central station, power plant and machine men, as great improvements have been made in the devices since exhibiting them at the Chicago and New York electrical shows of recent date. The company was seriously handicapped and put to loss due to the fact that the greater part of its exhibition was lost in transit. The exhibit was in charge of General Manager C. H. Vaughen.

THE FEDERAL ELECTRIC COMPANY'S exhibit was composed of porcelain enamel steel signs for central station use. These most attractive blue signs made a conspicuous showing on the main aisle. The attention was attracted by the words "Federal" and "Signs" flashing out across the hall, and was easily held by the genuine attractiveness of the exhibit. A sign of the panel type which had seen four years of actual service on Van Buren Street, Chicago, was also shown. This sign was in perfect condition, and had never been re-enameled or repaired, thus illustrating the investment value of Federal signs to central station men. The booth was in charge of Mr. James M. Gilchrist, general manager, and Mr. W. J. Norton and L. G. Shepard, of the New York office.

THE EXCELLO ARC LAMP COMPANY, INC., exhibited its well-known Excello "Sunray" and Excello "Snowball" lamps, which for some months past have been seen in the larger cities of the United States and have become a very familiar sight on Broadway, New York's "Great White Way." The Excello "Sunray" is intended for outdoor use, the Excello "Snowball" for indoor use. The "Snowball" lamp on the exhibition hall ceiling was much admired. The Excello miniature lamps created a good deal of attention owing to their economy in current—one candle per watt consumed—for use in small rooms. Great interest was also paid to Excello lamps exhibited outside the company's stall in various parts of the hall and pier. Messrs. Hirschberg, president; Baerwinkel, secretary, and Dinsmoore, technical superintendent, represented the company.

THE SHELBY ELECTRIC COMPANY exhibited its well-known useful light lamps in all the various types and styles. The electric sign over its booth, which was lamped with Shelby 4-cp sign lamps, showed at a glance the remarkable illuminating power of this type. A practical demonstration of the relative amount of light thrown downward by the Shelby as compared with the standard anchored filament type was afforded by two pairs of small booths lined with black cloth. In one booth 16-cp, 56-watt lamps were used—one lamp at the top of each booth. A glance at the piece of paper at the bottom of the Shelby booth showed that it was receiving, it was claimed, 50 per cent more illumination downward than the paper in the other booth. The papers on the bottom of the second pair of booths were receiving about equal illumination, but in this case a 45-watt Shelby lamp was used whereas the other lamp was using 56 watts. The new Shelby tantalum lamps were shown for the first time, and attracted a great deal of attention. The exhibit was in charge of Messrs. W. E. Groves and F. M. Haskell.

THE SIMPLEX ELECTRIC HEATING COMPANY, Cambridgeport, Mass., had a large triple booth in the northeast corner of the hall, where it displayed and demonstrated electric heating and cooking apparatus of almost every conceivable kind and type In fact its exhibit afforded a practically complete exposition of this modern and growing use of electricity. Among the apparatus were flatirons, tailor's gooses, chafing dishes, ovens, stoves, tea kettles, percolators, medical and dental sterilizers, heating pads, nursery milk warmers, radiators, soldering irons, glue pots, shoe and treeing irons, rheostats and resistance units. The new "Kitchenette" is deserving of particular mention. This is a complete equipment for baking and cooking and includes a large oven on the top of which are all the necessary facilities for boiling, frying, etc. Part of the booth was fitted up as a kitchen and two demonstrators were kept busy trying doughnuts, baking cake and making coffee, which, judging by the appetites of the visitors, was a great success. The exhibit was in charge of James I. Ayer, manager of the company, and Roger Williams, C. H. Johnson and Charles W. Richards.

The Brilliant Electric Company, of Cleveland, Ohio, was represented by E. J. Kulas, general manager. While no formal exhibit was made, the new Brilliant tantalum lamp, with which a number of booths were lighted, attracted a great deal of favorable comment.

The National Carbon Company, Cleveland, Ohio, was very much in evidence in the person of Mr. N. C. Cotabish and twenty-two salesmen, who took advantage of the occasion to hold their annual sales department reunion, in addition to meeting their many friends among the lighting men. Mr. Cotabish was accompanied by Mrs. Cotabish and Miss Cotabish. The company was represented by D. D. Dickey, general manager; N. C. Cotabish, sales manager; H .E. Hackenburg, treasurer; J. F. Kerlin, assistant sales manager; A. D. Spear, A. N. Barron, factory manager; J. S. Crider, secretary; Wallace O'Connor, A. V. Ward, A. C. Henry, A. E. Carrier, J. C. Irvine, F. C. Park, W. C. Banks, F. J. Kysela, E. J. Kenny, C. W. Wilkins, F. H. McDowell.

The Philadelphia Electrical & Manufacturing Company, of Philadelphia, was represented by Mr. C. L. Bundy and Mr. R. H. Manwaring. Its exhibit was one of the most interesting on the pier. Among other things that it showed were its incandescent street lighting fixtures, absolute cut-outs, joint wrappers and plugs for conduits, fuse boxes and a section of a model manhole which attracted a great deal of attention. No man who attends these conventions is more popular than its president, Mr. C. L. Bundy.

The Standard Paint Company, 100 William Street, New York, was represented by Messrs. J. N. Richards, general sales manager; C. E. Smith, manager paint department; P. M. Wade, manager advertising department. This company exhibited in the interests of the well-known P. & B. products and especially the new line of P. & B. baking and air drying insulating varnishes, which it recently placed on the market. The company had a handsome booth in the front rank in the main exhibition hall.

The Atlantic Electric Light & Power Company, of Atlantic City, which is the local lighting company, made a very handsome and successful exhibit of electric heating and cooking apparatus, all of which was specially furnished by the General Electric Company. The exhibit was in charge of Mr. M. W. Byers and attracted a great deal of attention on the part of delegates and the public. A variety of apparatus was put to constant use during the convention. This apparatus has already been described in the Electrical World, but is undergoing constant improvement.

Gould Storage Battery Company exhibited a complete line of its output, including one of its type U-49 element in a U-49 lead-lined tank set up with the double insulation, also a 19-plate S element in a lead-lined tank, together with its portable type of cells, including sparking sets, couples and tandem type, with miscellaneous parts. The sample boards showed the detail of the stationary type, one of the special features recently introduced by it, namely the new V grooving, which has many advantages. The vehicle type was also shown. Pictures of a great many new installations were shown. The representatives of the Gould Storage Battery Company were Frederic W. Hulme, H. M. Powers and L. L. Littlefield, Jr.

The Dearborn Drug & Chemical Works had one of the most unique and handsome booths at the convention. The decorations were white and gold, handsomely supplemented with rugs and chairs for reception purposes. One of the features of their exhibit was a beautiful oak case which was filled with cut glass bottles containing samples of all of the various products of the company. The lower portion contained a suggestive exhibit of boiler scale and corroded and pitted tubes and valves, showing the nature of the evils which the Dearborn compounds are intended to overcome. As usual the company was liberal with souvenirs of various kinds—useful and humorous. The ladies were presented with a handsome box containing two bottles of choice perfume, the products of the Dearborn laboratories. The Dearborn Drug & Chemical Works have made great progress in their work among manufacturers and steam users in general, and at the convention were consulted as authorities on the subject of steam economies. Those representing the company were Mr. Robert F. Carr, vice-president and general manager; Mr. William B. McVicker, second vice-president and Eastern manager; Mr. Geo. R. Carr, assistant general manager; Mr. Robert W. Francis, general Western manager; Mr. H. G. McConnaughy, New Jersey manager.

Westinghouse Electric & Manufacturing Company.—The Westinghouse exhibit occupied a large space in Exhibition Hall on the right-hand side of the entrance. The exhibit was very daintily arranged. Green drop curtains surrounded the booth on all sides, while the floor was covered with matting which harmonized in color. One-half of the booth was set apart for a reception room, with easy chairs. A feature of the exhibit was a large model of a Westinghouse type C single-phase watt-meter for 3,000 alternations. This meter may well be referred to as the largest meter in the world, because it stood 10 ft. high and about 4 ft. deep from face to rear. The meter is built of wood, but is finished so as to serve as a very good representation of this line of meters and has the gear motor-driven. On all the posts supporting the brass rail about the exhibit were kept in operation the different styles of fans made by the Westinghouse Company. Overhead were in agreeable operation a half dozen of the new type Westinghouse ceiling fans. The exhibit on one end was lighted by Nernst lamps and on the other side by type K Cooper Hewitt mercury vapor lamps. A very complete line of Westinghouse arc lamps was displayed. Two Westinghouse alternating-current multiple arc lamps, 110-volt, and two direct-current multiple arc lamps 110-volt, were burning. A special feature of the Westinghouse exhibit was the new Nernst series alternating vertical glower system of street light. The system as shown consisted of four 60-cp lamps having single vertical glowers and spirally wound, heaters mounted in strong weather-proof housings with reflectors and series transformers directly secured to a rack in the center of which was hung a standard Westinghouse series alternating-current arc lamp. The system was operated from a standard Westinghouse panel and a 6-lamp, air-cooled, constant-current transformer. It was stated that the actual watt consumption from the bus-bars was less than 2 watts per candle for the system and that 115 watts were taken by each lamp at the transformer primary or for the series of four lamps the watts taken were about equal to that of the single arc lamp on the same current. The apparatus exhibited by the Westinghouse Company included, in addition to the line of fan motors, arc lamps, a line of small motors from 1/20 hp up, a very complete line of current-measuring instruments of both portable and stationary types, lightning arresters, auto-starters, a complete line of switches and circuit-breakers. The different lines of Westinghouse transformers were covered pretty thoroughly in capacities of 6 kw, 7 kw, 15 kw and 50 kw sizes. These capacities were shown in the Westinghouse type OD, type N, type C. Enlarged views of important installations of the Westinghouse Company were shown at the exhibit by means of the large revolving photograph holder which was built for the St. Louis exposition. In addition to other decorations the Westinghouse Company had a very pretty design of flags showing the world in white relief on blue duck. These were seen in all parts of the exhibit as well as the headquarters at the Marlborough-Blenheim. The Westinghouse Companies publishing department had prepared for distribution from the Westinghouse booth and also from the Westinghouse headquarters in the Marlborough-Blenheim, an album, "Westinghouse Views," in which were shown some beautiful half-tones in sepia tint, of the works and installations of the different companies. In connection with the distribution of this album the Westinghouse Companies brought their photographer to the exhibit and took views of persons attending the convention. Photographs were furnished and bound in the album before being given out, so that all who sat for photographs were able to carry home one of these souvenirs with their own likenesses forming a part of the book. This album was not confined to any one of the companies, but showed interesting views of the interior of the works of the Westinghouse Electric & Manufacturing Company, the Westinghouse Air Brake Company and the Westinghouse Machine Company, and also showed some novel installations. The exhibit was in charge of Mr. J. C. McQuiston, the superintendent of the Westinghouse Company's publishing department. Mr. S. P. Wilbur, of the Nernst Lamp Company, and Mr. E. D. Hays, of the Cooper Hewitt Electric Company, represented their respective companies at the exhibit.

CHARLES WIRT & Co., of Philadelphia, was represented by Mr. Chas. Wirt.

HENRY D'OLIER, JR., of Philadelphia, was represented by Mr. Henry D'Olier, Jr., and Mr. C. W. Wardell.

MR. WALTER C. LEARY, of the Bogia Regulating Socket Company, Philadelphia, was shaking hands with his many friends.

MR. RAY D. LILLIBRIDGE, the publicity manager for a number of electrical concerns, was on hand throughout the proceedings.

THE LEEDS & NORTHRUP Co., of Philadelphia, makers of electrical measuring instruments, was represented by Mr. Julius Bernstein.

WESTERN ELECTRIC COMPANY made no exhibit, but sent Mr. Ed. Keefer from New York, as well as some of their home, Chicago, staff.

THE H. T. PAISTE Co., of Philadelphia, was represented by Mr. H. T. Paiste, Mr. E. A. Jenkins, Mr. Geo. "Aleck" MacElween and Mr. Frank Booth, of Boston.

THE HOLOPHANE GLASS COMPANY (sales department) represented at the convention by Mr. V. R. Lansingh, general manager, had Holophane globes and reflectors in a number of places on the pier.

JOHN A. ROEBLING'S SONS Co., of Trenton, N. J., was represented by Messrs. H. L. Shippy, treasurer; A. Mann, C. B. Cushing and G. W. Swan, salesmen, and A. W. Barber, manager of the advertising department.

FEMCO LAMPS.—The interests of the Franklin Electric Manufacturing Company and Femco lamps were ably cared for by Messrs. P. Spang Klees and Chas. N. Thorp, of Hartford, and by G. O. Curtis, manager of the Buffalo office.

PARTRICK, CARTER & WILKINS, of Philadelphia, were represented by Mr. C. M. Wilkins, who came in on Wednesday and was as much at home on the boardwalk as on his native asphalt near the City Hall, on which Penn is pedestalled.

THE BOOK DEPARTMENT of the McGraw Publishing Co., for the first time at a convention of the National Electric Light Association, exhibited a complete library suitable for a central station. A catalog was especially compiled for the occasion, giving a carefully selected list of books for central station managers, engineers and other officers in charge of construction and operation. The exhibit was in charge of Mr. C. J. Doyle.

THE NATIONAL METALLIC MOULDING COMPANY, of New York, manufacturer of "Flexduct," flexible conduit and "Economy" rigid conduit, had an attractive booth in charge of Messrs. C. E. Corrigan and J. A. Campbell. A large electric sign proclaimed the "House of Flexduct and Company." Samples of both kinds of conduit in various sizes were exhibited, and comfortable chairs made the booth an attractive resting place for the many friends of the company and the gentlemen in charge. The company distributed stylographic pens as a souvenir.

THE "X-L" SOCKET CLAMP was shown by Max Loewenthal, 150 Nassau Street, New York. The object of this clamp is to hold the key of a lamp socket in the "on" position, so as to prevent any one from turning it off in case a heating device, consuming more than 3 amp. is connected to the socket. Experience has shown that many key sockets are destroyed in this manner and in each case this means a dissatisfied customer. Central station men who saw this novel and simple device were pleased with the manner in which it overcomes a very objectionable feature.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, with its usual progressiveness, was the first incandescent lamp company to have its exhibit in place and the first company to show commercial tantalum lamps. The new Buckeye tantalum with its brilliant white light and its great saving in current consumption attracted much favorable comment. A cluster of seven of these lamps in the center of the booth made a dazzling display and tantalums were used in outlining the booth as well as other booths. Of course the Buckeye carbon filament lamp was shown in all the various types. The exhibit was in charge of L. P. Sawyer, manager of the company, and J. M. Smith, Philadelphia salesman.

ONEIDA COMMUNITY, LTD.—The exhibit of the Oneida Community, Ltd., of Oneida, N. Y., manufacturer of weldless steel chain, besides showing its full line of over 60 different styles and sizes of chain, was particularly laid out to illustrate to central station men the advantages of Oneida galvanized chain for raising and lowering arc lamps. Onedia galvanized chain is also used extensively for hanging electrical signs. Its uniform reliability and durability together with handsome appearance has brought it into great favor. The makers laid special emphasis on the weather-proof qualities of the Oneida chain, it being carefully and smoothly covered with pure zinc by the hot process. The exhibit was in charge of Messrs. S. R. Leonard and V. W. Lee.

AMERICAN CIRCULAR LOOM COMPANY has just put upon the market and exhibited the "Lutz Metal Molding," made of rolled steel with a sliding cap. A complete line of fittings included standard and adjustable "T" elbows, which can be adjusted to any desired angle. The system shown also included special fittings for connection of the molding to rigid conduit systems, together with knock-out out-let boxes and porcelain receptacles and rosettes. The entire line of fittings is designed to prevent the capping ends from coming in contact with the conductors. The "Lutz" metal molding represents an advance over the ordinary wooden molding of former practice as pronounced as that of the rigid steel conduit of to-day over the paper tubing of former years. The principle advantages appealing to the electrical constructionist would seem to be, first, the smaller size of the "Lutz" metal molding as compared with the wooden molding for the same size conductors, the difference being about one-half in favor of the former; and secondly, the obstacle presented by the steel molding to the driving of screws by the laymen, who has frequent use for the wooden molding as a hat rack, picture support, or any other purpose foreign to that to which it is designed. This new material, representing as it does such a long step in the advancement of the exposed electric wiring, was received with most favorable consideration from engineers and inspection authorities as well as from wide-awake central station men. The company also exhibited a line of its well-known American circular loom tubing and enameled conduit known the world over as the "Electroduct." The company was represented by Mr. H. B. Kirkland, general sales manager, New York; R. B. Corey, New York representative; Mr. H. C. Adams, of New York, and Mr. Alex. Henderson.

H. W. JOHNS-MANVILLE Co., New York, had a complete line of "Noark" National Electrical Code standard enclosed fuses and fittings and standard and special service and subway boxes for 250, 600 and 2,500 volts. It included also enclosed fuses and cut-outs for service up to 10,000 volts; service switch fuse boxes with complete inlet and outlet attachments, as required and approved by the National Board of Underwriters; high-tension porcelain transmission insulators for 80,000 volts service and lower; asbestos "Transite" fire door for sub-station work, and other similar purposes where insulating and fire-proof properties are essential for the protection of property and attendants; "Niagrite" tape for wrapping lead and weather-proof cables located in power houses, sub-stations and manholes for preventing destruction by short-circuit, etc., and strain insulators for high-tension transmission lines up to 10,000 volts having a tensile strength of 8,000 lb. In these all metal parts under strain are insulated with heavy sheet mica. The exterior is covered with moulded mica, a weather-resisting compound having great dielectric strength. The exhibit included also moulded mica weather-proof sockets for park and street decoration. The company gave as a souvenir a match safe and ash tray constructed after the design of its "Noark" National Electrical Code standard fuse plug made in porcelain and mounted in a solid bronze ash tray, showing embossed "N.E.C.S." fuses, National Electric Light Association, date and place of convention, cast in raised letters. The illuminated signs in the space showed asbestos and magnesia products and "Noark" enclosed fuse material. Those present for the company were J. W. Perry, manager electrical department, New York, and S. G. Meek, C. N. Manford, manager advertising department, and Charles Brennen, A. D. Newton, Boston; H. M. Voorhis, Philadelphia; E. B. Hatch, president the John Pratt Co., Hartford, Conn., and Robert Chas. Cole, electrical engineer, the John Pratt Co., Hartford, Conn.

The Crouse-Hinds Company, Syracuse, N. Y., was represented by Frank M. Hawkins, manager of the New York office.

Munder Lamps were most brilliantly conspicuous in a huge sign on the roof of Young's Pier, and in Prest. C. F. Munder from the Springfield factory.

Bryan-Marsh Company made a neat exhibit in a central space of its new 2-watt tantalum lamp, under the care of Mr. S. E. Deane, engineer of the company, and Mr. G. G. Lockwood.

American District Steam Company.—The interests of the American District Steam Company, Lockport, N. Y., were cared for by general manager Charles R. Bishop.

Mr. S. B. Condit, Jr., general manager of the Condit Electrical Manufacturing Company, Boston, was prominent among the New England manufacturers who were present.

National Carbon Company.—Prominent among the National Carbon Company delegation were General Manager D. D. Dickey, Secretary J. S. Crider and Sales Manager N. C. Cotabish.

Mr. Henry M. Shaw, manager of the New York sales office of the Lord Electric Company, was on hand and distributed bulletins on the Shaw lightning arrester and Thomas rail bonds.

J. G. White & Co., of New York and everywhere, had vice-president Gossler in attendance, to represent their extensive central station interests. Mr. Thornton, of the Rosslyn, L. I., plant, under their care, was also present.

The Vulcan Electric Heating Company. of Chicago, manufacturer of Vulcan electric heating specialties, was represented at the convention by President F. J. Holmes, who distributed a card bearing an illustration of its soldering iron.

The American Vibrator Company gave a successful exhibition and demonstration of its vibrator, which attracted general attention and resulted in many sales. The exhibit was in charge of Mr. B. F. Small, of New York, manager, and Joseph O'Brien and G. F. Wilcox.

The Benjamin Electric Company, of Chicago, sent Mr. B. G. Kodjbanoff, its manager, who made no exhibit, but was so loquacious on the subject of its specialties in the way of clusters and "arc lamp displacers," that the absence of the goods was in reality unnoticed.

The Okonite Company was represented and conspicuous in the person of Mr. Willard L. Candee, known to every old-timer, and with a memory and an electrical acquaintance running back to the days when the arc, the incandescent and the electric motor were not known in the land. Mr. Romaine Mace was also present from the New York office.

The Standard Underground Cable Company made a fine exhibit of team play by the Wiley Brothers, who were the unanimous selection to head the Eastern and Western baseball nines. Mr. Hughes came over from Philadelphia, having heard a faint rumor that there was a convention going on.

Dr. W. M. Habirshaw, whose name long since became a synonym for all that is highest and best in insulated wire and cable manufacture, and whose career in the electrical field embraces all the great work this side of the development of telephony, was present throughout the meeting, having, in fact, spent a large part of the winter and spring at Atlantic City.

The Dale Electric Company sent President John H. Dale, who distinguished himself by having a gorgeous sign as to his specialties right over the big fish tank. The guesses as to the answer were most amusing, but Mr. Dale says the prize winner has not yet appeared on the scene. The idea of calling these denizens of the deep "wireless clusters" could only have occurred to a genius of the Dale stamp. B. C. Heather and H. S. Rainsford were also in attendance.

The Electrical World had a fine booth right at the main entrance and ticket office, dominating the entire scene. Lavish distribution was made of the issue of June 2, containing the record number, of 320 pages, and the technical book publications of the McGraw Publishing Company were also in brisk demand. The editorial staff was represented by Messrs. Martin, Cravath and Knowlton, and the business department by Messrs. Wakeman, Elliott, Beard, Walker and Doyle. Mr. McGraw was in attendance part of the week.

G. M. Gest, of New York, the well-known engineer and contractor for underground work, had an exhibit in charge of R. E. Brandies. The booth was decorated with photographs and plans of a number of recent installations. Cable racks and other appliances were shown as well as vitrified conduit in various forms. "Rundle's Underground Electrical Cable Recorder," for which G. M. Gest is sole agent, attracted a great deal of attention. This system affords an easy and accurate means of keeping a complete record of the progress of underground cable installations.

The Moore Electric Lamp illuminates the lobby immediately in front of the theatre. This lobby measures about 46x78 ft., with a ceiling 17 ft. high. The tube was 187 ft. long and 1¾ in. in diameter. It conformed approximately to the shape of the room, producing a symmetrical and artistic effect. The light is due, as our readers know, to an alternating current conducted inside of the glass tube by a very small quantity of non-metallic gas. The tube was adjusted for 12 cp per ft., making a total of 2,244 cp. The total watts from the street circuit supplying this tube were 3,370, on this basis, which would give a consumption of 1.5 watts per cp.

The Beck Flaming Lamp Company, of No. 58 West Fifteenth Street, New York, exhibited its Beck flaming arc. Mr. L. J. Auerbacher, president of the company, was kept busy showing the lamp. The powerful light (3,000 cp), combined with the extreme simplicity of the lamp, were points of much interest to the delegates. The Beck lamp differs radically from others, as it has no regulating mechanism, the feed is accomplished by means of one of the carbons having a rib, which rests on a metallic support. This rib burns to a fine point, which gradually disintegrates, allowing the carbons to feed by gravity. Mr. Auerbacher reports a large number of sales of this lamp and predicts a great future for the flaming arc.

The General Storage Battery Company gave a demonstration of its constant current regulating system, used for increasing the load factor of a power plant, where there is a heavily fluctuating load, due to electric elevators, electric hoists, electric railway companies. This was demonstrated by means of a small Bijur cell, their standard type F15 in glass tank, whose normal capacity is 84 amperes. By means of a solenoid switch instantaneous loads of over 1,000 amperes are drawn from the cell, and the constant charging current was maintained at approximately 100 amperes. A kick of only 9 amperes of this 2,000-amp. jerk reached the generator, this giving regulation of less than ½ of 1 per cent of the assumed load. A standard battery case for railway signals, standard car lighting cells, and a yacht lighting outfit were also on exhibition. The company was represented by Mr. R. C. Shaal and Mr. F. E. Booss.

General Electric Company.—The General Electric Company had a reception booth attractively decorated with palms and brilliantly illuminated with the new General Electric tantalum filament lamps, the new "Gem" filament high-efficiency incandescent units, the new "Gem" Meridian units, and the new "Gem" filament 20-cp, 50-watt lamps. These were displayed in combination with forms of the Holophane pagoda reflectors giving the various types of lighting distribution. A new form of pagoda reflector for high candle-power units was shown, known as the "bowl," or form B reflector, which has a very graceful contour, and permits the use of a clear lamp, thus giving an advantage in lamp renewal costs. Some handsome spun brass ceiling canopy fixtures were shown, for use with the new high candle-power units for supporting the lamps directly from the ceiling. The sign, bearing the name of the General Electric Company, was lighted with the new Edison sign lamps, giving 2 candle-power with the consumption of 10 watts, for multiple lamps. Samples were shown of the "Gem" filament street series lamps consuming 2.7 watts per candle. The feature of special interest was the exhibit of tantalum lamps, which are now being manufactured by the General Electric Company in this country. These lamps have the highest efficiency of any present available form of incandescent lamp—consuming only 2 watts per candle, giving 25 cp with 50 watts consumption, with a life on direct current of 700 hours.

THE DOUBLEDAY-HILL ELECTRIC COMPANY, of Pittsburg, sent Mr. Elliott Reynolds, traveling representative, to speak for its interests.

MR. WM. T. PRINGLE, of Philadelphia, the well-known manufacturer of the Ries regulating "socket," circulated among his many friends.

MR. JOHN L. GLEASON exhibited a complete line of his patented lighting specialties. The booth was in charge of Mr. Gleason, assisted by Mr. Reinhold Eberhardt.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, was represented by Mr. J. F. Stevens, president; Mr. Arthur Organ, New York representative, and Mr. Louis J. Costa, Philadelphia representative.

THE JANDUS ELECTRIC COMPANY, of Cleveland, O., was represented by Mr. Arthur Organ, manager of the New York office, and Louis J. Costa, Philadelphia manager. Both gentlemen were kept busy renewing old acquaintances and making new ones.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., exhibited new alternating and direct-current meters. It also distributed to the members of the association paper weights in the form of a miniature Sangamo meter, as souvenirs. The exhibit was in charge of Mr. R. C. Lanphier, secretary, assisted by Mr. T. F. McKenna, of Machado & Roller, the company's Eastern representatives.

THE CURTIS ADVERTISING COMPANY, of Detroit, Mich., displayed in a very attractive booth specimens of its work. The back wall of the exhibit was covered with circulars, booklets, and original drawings, made for its customers, the object of this display was, of course, to demonstrate to electric lighting men the application of methods pursued in other fields to the selling of current. The company was represented by Mr. Parker.

THE AMERICAN ELECTRICAL HEATER COMPANY exhibited a large number of standard electrical heating appliances, part of the full line of 157 different articles made by this company. The new "Steel Clad" electric iron attracted considerable attention and caused much favorable comment. A large number of the appliances were entirely new. The great interest shown in electrical heating devices was evidenced by the number of questions asked by delegates, and Mr. B. H. Scranton, president, and Robert Kuhn, secretary, who represented the company, were agreeably surprised at the large amount of technical data required by the delegates.

THE INDIA RUBBER & GUTTA PERCHA INSULATING COMPANY, of New York, was represented by Mr. J. B. Olson, sales manager, who had to answer a number of questions as to the equipment of Habinshaw wires and cables furnished for the grand new Hall of Records in New York City. The work in this building is all of the highest grade, and Mr. Olson regards the contract now executed as quite a "feather in the cap" of the "I. R. & G. P." This veteran met a host of friends and admirers, being known intimately by all the leaders in the lighting art, and was a center of hospitality during the week. It gratified all to see him so well and strong.

THE ELECTRIC SERVICE SUPPLIES COMPANY, or Philadelphia and Chicago, being a consolidation of the Mayer & Englund Company, of Philadelphia, Porter & Berg, of Chicago, and the Garton-Daniels Company, of Keokuk, showed several of its special lines of electrical and railway material for which it acts as agent or manufacturer. Its exhibit included a full line of the well-known Garton lightning arresters, the automotoneer, and the Keystone cable hanger, as well as a very handsome sample board of the Safety Insulated Wire & Cable Company's products. The Electric Service Supplies Company was represented by Mr. W. B. Cosper, of the Garton-Daniels department; Mr. H. G. Lewis, of the Mayer & Englund department; Mr. A. S. King, of the Sterling Varnish Company, and Mr. A. P. Eckert, of the Safety Insulated Wire & Cable Company. The Electric Service Supplies Company is agent for the two last mentioned companies.

THE WAGNER ELECTRIC MFG. COMPANY, of St. Louis, had a very interesting exhibit, showing its well known line of standard single-phase motors, variable-speed single-phase motors, and the new single-phase elevator motors. The central station men were particularly interested in this latter type of motor as it is what they have been looking for. Elevator work is a class of service they have not all been able to handle satisfactorily heretofore. The motor and controlling device have been perfected, and the Wagner Company said it is prepared to push the sale. Forty motors of this type have already been sold and are in successful operation. Its line of standard lighting transformers, and portable and switchboard type instruments, were also exhibited. The combination voltmeter and frequency indicator were very favorably received by the operating engineers. Representing the Wagner Company were General Manager W. A. Layman, Assistant General Manager Walter Robbins, of St. Louis, and District Managers E. W. Goldschmidt, New York; Brooks Taxson, Boston; John Mustard, Philadelphia, and A. W. Wycoff, Pittsburg.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, manufacturers of the chloride accumulator, exhibited many types of cells and instruments used in central station practice. A sample battery of 1056 cells installed and contracted for by the Chicago Edison Company, consisted of 61 type H plates 15 5/16 x 30 11/16 in., assembled in a reinforced lead-lined wooden tank, approximately 59x22x50 in. This is one of the smaller types of cell used by the Chicago Edison Company. Cells of types R, G, F and E were also shown. A most interesting part of the exhibit consisted of a 20-point 2,000-ampere horizontal type end-cell switch operated by push-button from a distant point. Mounted on the switchboard was an electrical indicator which showed the exact position of the end-cell switch contact with respect to the end cells. Testing instruments were shown, among which may be especially mentioned a compensating hydrometer correcting differences in electrolyte density, due to changes in temperature; a signaling hydrometer, notifying the station attendant of the completion of charge and discharge; and an automatic cell-filling device for replacing water evaporated in the pilot cell. Mr. C. Blizard, sales manager, with a full staff of assistants, received a host of callers.

ALLIS-CHALMERS EXHIBIT.—As visitors to the National Electric Light Association Convention entered the hall on Young's Pier, their attention was attracted by the large electric sign of the Allis-Chalmers Company suspended over a very handsome exhibit and reception space. The exhibit included an induction motor generator set of 50 hp capacity; six induction and direct-current motors; a potential regulator and a small model showing the moving and stationary blades of the Allis-Chalmers Company's steam turbine. The booth itself was fitted out with "mission" furniture, with posts and railings stained a green to match it. The floor was covered with green denim, and a profusion of palms and plants placed entirely around and through the enclosure, gave to the exhibit a rather festive air, which was heightened by bunting draped on either side of the red, white and blue electric sign. A number of souvenirs were distributed from the Allis-Chalmers Company's booth, the most eagerly sought being a badge showing, on one side of a German silver medallion, an Allis-Chalmers steam turbine generating set, and on the other, one of its large gas engines coupled to an alternating-current generator easily recognizable as of the company's build. Engineers and other directly interested in power plants were shown a very neat, framed photograph of the Allis-Chalmers Company's turbo-generator, which has made so remarkable a record in the Williamsburg station of the Brooklyn Rapid Transit Company. This picture, printed in brown tint on portrait paper and encased in a frame of the same color, was also given as a souvenir. A full line of the company's power and electrical publications was also displayed, the one most frequently called for being No. 1504 on steam turbines and generators, which has just been issued. The Allis-Chalmers Company's exhibit was arranged by Mr. C. A. Tupper, of the Milwaukee office, who remained in charge of it. Among those who assisted in entertaining visitors at the booth were Messrs. W. S. Doran, George B. Foster, J. C. M. Lucas, M. W. Thomas, W. H. Powell, G. Strafer, P. S. Gibson, F. L. Bunton, L. E. Bogen, G. W. Pulver and others of the company's salesmen and engineers, some of whom arrived too late for the first registration.

Geo. W. Vallee Electric Company, of Atlantic City, was represented by Mr. Geo. A. Vallee.

Vallee Brothers Electric Company, of Philadelphia, was represented by Mr. G. A. Vallee, president.

The Helios Mfg. Company, of Philadelphia, was represented by Mr. Thomas Spencer and Mr. S. W. Miller.

Mr. Richard L. Binder, of Philadelphia, the "Special Electrical Supplies" man found himself among friends.

Valentine Electric Sign Company, of Atlantic City, was represented by Mr. T. E. Valentine and Mr. G. A. Vallee.

The Shelton Electric Company, Chicago, Ill., exhibited in the Fort Wayne Electric Company's space the Shelton vibrator, which is manufactured by the company first named.

American Silk Mfg. Company, of Philadelphia, was represented by its president, Mr. Felix Haac, who gave samples of its well known raw silk wipers. These wipers have been popular for many years, and have been endorsed by the Philadelphia board of fire underwriters.

American Diesel Engine Company, of New York, was represented by Mr. Norman McCarty, general sales manager; Mr. Jas. D. MacPherson, Mr. Herbert B. Rust, New England agent; Mr. Francis Head, Philadelphia agent, and Mr. Geo. F. Murphy, New York office.

Tipless Lamp Company.—Its exhibit in charge of R. S. Carrick and H. J. Jaeger, showed the new high-efficiency Jaeger "metallic filament" lamps which, burning at 16 cp, consumed but 40 watts per lamp, or 2½ watts per candle. Another specialty was a 2-cp sign lamp, that consumed but 10 watts per lamp, burning in multiple. Both of these new lamps were carefully looked over by many central station people, to whom the efficiencies made a strong appeal.

The Pittsburgh Transformer Company, represented, in an artistic booth in the theatre lobby, by Mr. H. G. Steele, exhibited a full line of Pittsburgh transformers for lighting in size from 1 kilowatt to 50 kilowatts, and a full line of transformers for power from 3 kilowatts to 50 kilowatts. The "Pretty Girls" were evident on the front page of a souvenir booklet. The reading matter of the booklet pointed out that the Pittsburgh Transformer Company is the largest manufacturer of transformers, exclusively in the United States.

The National Brake & Electric Company exhibited a 10-hp direct-current motor and had apparently exceeded the usual standards in quality and strength of materials. Its exhibit of a 7½-hp induction motor of variable speed attracted considerable attention owing to its simplicity of design and construction. It also exhibited its new type of alternating-current, direct-current compressor with a capacity of 25 cu. ft. of free air per minute. It was represented at the convention by Mr. R. P. Tell, vice-president and general manager; Mr. S. I. Wailes, general sales manager; Mr. W. H. Watson, chief engineer, and Wm. W. Power and Wm. H. Goble.

The Crocker-Wheeler Company showed its line of small direct-current motors; also numerous photographs of installations of this type of apparatus. It exhibited one of its core type power transformers, to illustrate the particular advantages of the core type transformer for high-tension power transmission. A field coil from one of the 4,000 kw generators for the Chicago Drainage Canal was also shown. The attendants were Messrs. R. N. C. Barnes, manager Boston office; Samuel Russell, manager Philadelphia office; F. B. DeGress, manager New York office; W. A. Appleton, Ampere office. The last named made a specialty of distributing artificial pinks dyed in the company's three colors, red, black and white.

The Phelps Company was in evidence, as usual, with a very unique and attractive exhibit. All the types of Hylo lamps were shown in various candle-power combinations. A pull-string lamp which it has just brought out, gives four intensities, 1, 4, 16, 20 cp, and the lamp is also turned on and off with the strings. The handsome sign "HYLO" was operated by its new 10-ampere flasher, which works perfectly. An attractive feature of the exhibit was a handsome nicely dressed wax lady in the center of the booth turning a Hylo lamp up, down, and out. This commanded a great deal of attention. The winking owl and the funny squinting yellow dog were very amusing to the general public. A souvenir postal card which the company distributed, had a musical score with the words glorifying the "Hylo." Under this was a picture of the whole family singing the praises of Hylo. This card made a decided hit.

The Fort Wayne Electric Works, Fort Wayne, Ind., had a large space on the east side of the hall in which was displayed a large variety of their apparatus. This included type K and type W integrating wattmeters, prepayment wattmeters, type A transformers, fan motors and form C arc lamps. The exhibit was in charge of A. A. Serva, assistant sales manager, assisted by T. L. Sturgeon, manager of the Philadelphia office; J. C. Lott, manager of the New York office; W. C. Knight, manager of the St. Louis office; C. A. Woolsey, E. H. Porter, J. A. Strauss and J. H. B. Van Zandt, of the Philadelphia Office; J. C. Moulton and S. A. Ochs, of the Boston office, and A. H. Boyd and S. S. Rothrock, of Fort Wayne.

The Board Walk in front of Young's Pier was brilliantly illuminated by the General Electric Company's magnetite arc lamps, burning in multiple, on 108-volt, direct-current circuit. One of these lamps was shown in the company's reception quarters and naturally attracted considerable attention as this was the first public presentation of this particular lamp. The General Electric representatives present were: J. R. Lovejoy, general manager lighting department; E. E. Gilbert, C. D. Haskins, P. D. Wagoner, W. S. Moody, G. E. Emmons, E. M. Hewlett, all of Schenectady; J. S. Anthony, A. D. Babson, New York; C. B. Burleigh, Boston; J. Scribner, of Chicago; A. F. Giles, Atlanta; H. P. Buddy, G. P. Thompson, of Philadelphia; J. J. Crowell, Syracuse, and F. H. Gale, publicity department, and many others.

American Instrument Company.—When new apparatus possesses real merit it is sure to attract attention; which fact explains why the direct-current instruments made by the American Instrument Company and exhibited at Atlantic City for the first time, were so carefully examined by the many engineers in attendance. The display of this company included switchboard voltmeters and ammeters of remarkably pleasing appearance; portable instruments accurate within ½ of 1 per cent; unmounted parts, instruments with cases removed and various switchboard shunts. The frankness of the company in showing every detail of interior construction excited most favorable comment, as it became evident that the instruments are so built as to deserve honor because of actual merit and that there is absolutely nothing to conceal. The feature of interchangeable shunts appealed strongly to switchboard engineers, for it means that any ammeter can be used with any shunt, or any number of shunts with one instrument. Mr. A. O. Benecke, chief engineer, was in personal charge of the exhibit, assisted by James B. Biddle, president, and T. G. Geixas, New York representative.

The Fibre Conduit Company, of Orangeburg, N. Y., made quite an extensive exhibit of its products, which was especially interesting on account of the fact that it showed its product in the various stages of construction. First it showed the wood pulp in the crude state as purchased from Canada in 5,000 ton lots. Then it showed the conduit wound in the untreated form. This untreated pipe is then placed in liquid asphalt and thoroughly impregnated. It next goes into the machine shop, where the ends are turned down to make the socket, sleeve, and screw connections, and it is then ready for the market. The business of the Fibre Conduit Company has doubled every year for the past three years and its output for 1907 will be 14,000,000 ft. The company also exhibited a sample of pipe that had been underground for ten years, being laid in direct contact with the soil without concrete protection. This showed no depreciation whatever. It also exhibited samples showing the effect of a short-circuit on its product. Engineers unfamiliar with fire conduit sometimes think that in the case of a short-circuit the duct would be totally destroyed, whereas it stands up fully as well as any other conduit under similar conditions. The company was represented by Mr. Stephen G. Thompson, manager New England office, Boston, Mass.; Mr. U. W. Smythe, Jr., manager of its western office, who has his headquarters in the Monadnock Building, Chicago, and also by its vice-president, treasurer and sales manager from the home office at Orangeburg.